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THE
GREAT CENTENNIAL
EXHIBITION.





A. M. I. Mueller & Co.

Columbia?



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INTRODUCTION.



THIS Introduction to the Great Exhibition of 1876 may be brief. All that is requisite for our purpose will be best set forth in the pages which follow; the general public has been so fully informed upon the several topics connected with the event, that to go into details here would be to occupy space which may be better expended.

The fame of the Exhibition has gone forth to the utmost bounds of the civilized world. The extent of its aim, as an Exhibition of the natural productions, the arts, sciences, manufactures, and fine arts of all nations—the ingenuity of its plan, the vastness of its departments, its exactness in particular, its beauty as a whole, its success in all the objects for which it was undertaken, the feelings of amity and benevolence it called forth, the enlargement of mind it gave rise to, the practical benefits necessarily springing out of the scientific contemplation of its contents, the unceasing source of delight it afforded to the thousands upon thousands who flocked, day after day, to behold its treasures, the brilliancy of its opening, the harmony of its close, the thankfulness and gratitude inspired in every reflective mind, during months of peaceful and rational enjoyment, undisturbed by any painful accident or jarring feelings,—all these are chronicled in such variety of form and language as to defy the power of oblivion; and we may safely pronounce that the Centennial Exhibition will exist in the annals of history long after the vaunted pyramids of Egypt, of which the builders and the object are already alike unknown, shall have crumbled into dust.

This book has been written for the purpose of supplying a descriptive

and critical analysis of the principal objects exhibited at the International Exhibition. The descriptive particulars are, for the most part, based upon the observations of the Authors, who have had frequent opportunities of examination. In addition, they have availed themselves of the co-operation of exhibitors in verifying and authenticating the descriptive matter of the work, to whom, in the majority of instances, proofs have for that purpose been submitted. These gentlemen have willingly responded to the Authors' applications, and they embrace this opportunity of acknowledging their courtesy. Upwards of three hundred and fifty objects of Art, Industry and Mechanics have thus been accurately noticed, or described in detail: constituting a compact Cyclopædia of the best things of the Exhibition, valuable as a text-book for students, and as a work of reference for all readers.

In the arrangement of this work the Authors have, in general, followed the classification of the buildings adopted by the Commissioners for the International Exhibition, and comprehended in the Official Catalogues.

Part I, on Fine Art: Paintings, Sculpture and the Fine Art Buildings.

Part II, on Industrial Art, and the Main Building, with its Annexes.

Part III, on the Manufacturing Machines and Tools for Working in Iron, Wood and other Materials; and the Machinery Hall.

Part IV, on Agriculture and Horticulture and their buildings.

Part V, on the Pavilions, Grounds, and Appendix relating to other International Exhibitions.

Though the Authors do not hope to satisfy everybody, they have endeavored, to the best of their ability, to do honor where honor is due; and, while they have avoided needless commentary, they have given prominence to the more remarkable works exhibited, in defining the course of improvement. The Engravings will be found of great advantage in illustrating the text.

In order that the Engravings should be faithful transcripts from the actual objects they profess to delineate, the proprietors have been at the expense of having all those objects photographed on the spot, with a patience and exactitude that would not pass over the smallest imperfection or deficiency, and whatever was not fortunate in the first instance was reproduced, till complete success was obtained. The labor of rendering *fac-similes* of these minute creations was immense, as will be readily believed upon inspection of them. The expense was of course proportion-

ate; but this expense, great—it may almost be said enormous—as it has been, the proprietors have willingly taken upon themselves, in the full confidence that they shall ultimately be remunerated by the generosity of an enlightened public, alike quick to discover excellence, and liberal in rewarding it, and which they flatter themselves will regard these exquisite gems with feelings somewhat akin to those inspired by the skilfully portrayed features of a valued friend, delighting equally from the truth of the resemblance, and the pleasing remembrances they call forth.

With regard to the account of the rise and progress of the Exhibition itself, the ensuing pages will be found to present the lively and graphic description that might be given in the course of social converse. The objects selected for representation are chiefly such as will always continue to gratify the lovers of beautiful forms, elegant designs, practical utility, and truthfully elegant illustration of the more remarkable buildings, and of which the descriptions will be found permanently useful, in guiding the taste, and inciting to excellence in whatever branch of ingenuity or of the fine arts it may be sought.

To review the Exhibition, if not altogether a task of entire satisfaction, is, at least, a source of profitable pleasure; the hundreds of thousands of all nations by whom it was visited cannot have failed to derive thence a powerful stimulus by which to judge rightly and wisely of Art in its many ramifications.

The Artist, the Manufacturer, and the Artisan learned the valuable lessons that are derived from *comparison* in actual and practical schools; they saw, and no doubt studied, the perfections and defects they are required to imitate and to avoid. Of the former especially there were innumerable examples, each of which might have been accepted as an instructor. Already there is evidence that such teachings were not in vain; and, with time, out of this Exhibition will issue immense results for the advancement of Science and Art and the spread of their salutary influence.

It is well to state that this is the only work of its kind which is attempted, as far as the Authors and Publishers know, and the expense of producing such as this is likely to deter others, and, now that the Exhibition is closed, it would be difficult indeed to gather the drawings necessary to produce the illustrations.

P. T. S.

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PART I.

THE ART GALLERY

AND

ART GALLERY ANNEX.





THE ART GALLERY.



IN the following choice examples, selected from the Art Gallery of the International Exhibition, and from the works there exhibited by every country, we shall endeavor to form a permanent pictorial gallery—a commemorative museum, indeed—that may be accepted by all who took a part in that Exhibition and who were interested in its success, as a faithful exponent of what it was while yet in existence, and as a true and trustworthy guide to what it could teach, after it had ceased to exist, and when its many gems had been again dispersed throughout the world. Fortunately this dispersion has not implied in every instance the return of the exhibited paintings and sculptures to their original homes, and to their producers, and to the countries in which were placed the scenes of their production. On the contrary, the prevailing tendency of the paintings and sculpture has been to seek for themselves new homes, and to establish themselves far away from the homes of their producers. Thus they carry out the interchange of ideas and experiences; and thus the works that originally were



"The Great Exhibition, 1856."

THE ART GALLERY.

[Southern Front.]

exhibited at once develop and perpetuate the grand influences for good of great universal exhibitions. All this changing of the homes of exhibited works, and all this interchanging of instruction and suggestion that accompanies every excellent production, go where it may, and is inseparable from its presence, serves but to increase the interest and the value of a faithfully illustrated work. Each engraved example becomes equally attractive to the new possessor of the original work, and to the producer who called it into existence.

To spare our space for the glories within we shall dispose of the Art Gallery buildings in as few words as possible. Our engraving of the Memorial Hall shows the front, looking to the south; on the summit of the dome stands the figure of Columbia with bowed head of salutation and welcome, the hand presenting the peaceful bays. The figure was modeled in clay by Mr. A. J. M. Müller, a German artist, resident in Philadelphia, and was cast in metal by a firm in the same city. After the figure was placed in its present elevated position, it was subjected to several changes; at first it stood with outstretched arms; next these were put down, the left hand resting on the end of a cornucopia, and the right hand gracefully holding forth the olive branch—this latter change rendered the whole more graceful than before; but a storm arose, and next morning found the lady minus the forearm of the right member. A course of patching was then instituted, ending in making a bad case worse. The same artist modeled for the founders eight figures or groups representing Commerce, Art, Industry, and Navigation, and the four quarters of the globe.

The building, which is in the modern Renaissance style, is composed entirely of granite, iron, and brick; the wooden partitions dividing the American and English, and French and German departments will be taken away after the Exhibition. The State of Pennsylvania donated \$1,500,000 for the erection of this magnificent building, which will remain permanently on its present site, and in the future will be used either as the legislative hall—should the capital be removed from Harrisburg to Philadelphia—or as the building of the Pennsylvania Museum of Industrial Art. The architect is Mr. H. J. Schwartzmann, a gentleman of original thought and remarkable for



[The Art Gallery.]

THE DEATH OF GENERAL WOLFE.

By Benjamin West, P. R. A.

"The Great Exhibition 1876."

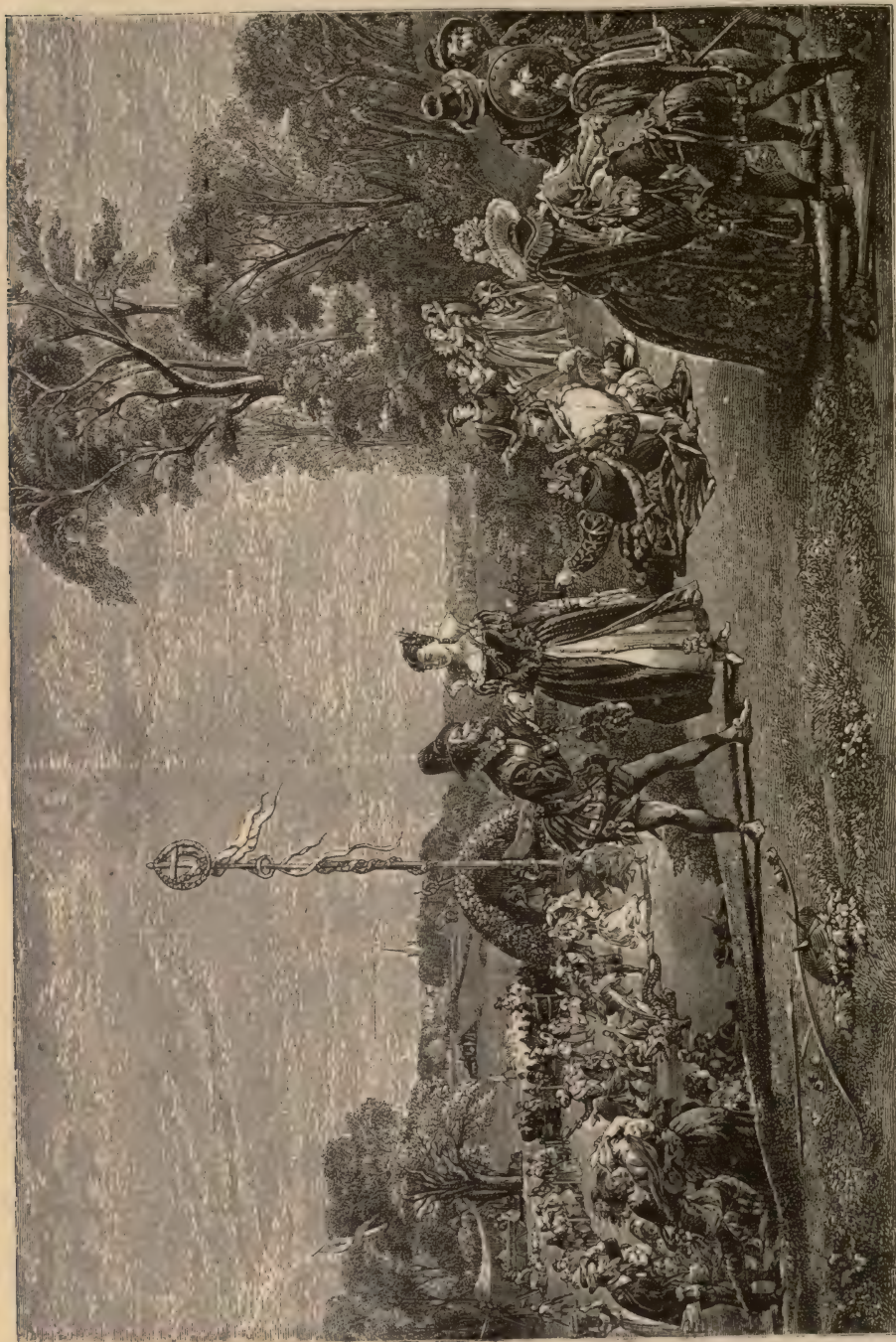
beautiful designing. It is only necessary to say that Mr. Schwartzmann is also the architect of the Horticultural Hall, and all who have seen these two buildings will have been pleased and gratified by their beauty.

The principal entrance to the Art Gallery is approached by a broad flight of granite steps, on either end of which are two pedestals supporting statues of Pegasus, in bronze, by a German artist, Mr. Pilz. The building is on a terrace eight or ten feet above the level on which the Main Building stands; it is three hundred and sixty-five feet in length, two hundred and ten feet in width, and fifty-nine feet in height, over a basement twelve feet in height, and, as will be seen from our illustration, is surmounted by a dome, which rises one hundred and fifty feet from the ground.

The south front of the building is composed of the main entrance of three arched doorways of equal dimensions; the doors are of iron, relieved by bronze panels having the armorial bearings of all the States and Territories, and in the frieze is the United States coat of arms. On either side of the doorways are arcades connecting the pavilions, at each end of the building, with the centre. The arcades are designed to hide the dead walls of the galleries, and consist of five groined arches each, and form delightful promenades looking towards the Main Building, whence are wafted strains of music, and many a wearied gazer has stood here to be rested from the crush within, and refreshed by the breeze from the balmy south. Behind the arches, and between the dead wall, are gardens with flowers and statuary and fountains.

The two pavilions—like the two promenades—are alike in construction, each containing a window thirty feet high by twelve feet in width; each of these windows were filled with stained glass windows—temporarily—by Exhibitors, and formed a pleasant relief in the hot summer days from the vertical light and heat of the galleries. On the summit of the four corners of each pavilion are eagles with extended wings.

The north front, facing to the Art Annex, in its ornamentation is like the south front, but the space of the arcades is occupied with a series of rooms which may serve in the future for committee rooms



"The Great Exhibition 1876."

MAY-DAY IN THE TIME OF QUEEN ELIZABETH.

By C. K. Leslie, A. R. A.

The Art Gallery

or studios; over these rooms are series of other rooms which might be useful for purposes similar to those underneath, but in the exhibition they were occupied with Industrial Art drawings, specimens of interior decoration, and cheap chromos,—the latter a curious perversion of the uses of an art gallery, and not creditable to the taste or judgment of the superintendent of that department.

The walls of the east and west sides of the building display the pavilions, and the walls of the galleries—and these are relieved by niches in which are to be placed statues. A terrace with *parterres* of flowers and grass surrounds the whole building except the north front, and the bronzes of the Dying Lionness on the south-east corner and the Naval Trophy on the south-west corner of the terrace relieve the comparative flatness of the ground.

When the wooden partitions in the principal gallery shall have been taken down, it will form a vast hall with noble arches and great height, and capable of containing upwards of seven thousand people; but now we are inside—let us see if we recognize any of the master-hands which have been using mallet and chisel and pigments for this display.

Washington! Is it thus we are to be greeted? This large bust in plaster by Señor Guarnerio, of Milan, is nothing to make one start in surprise, unless it be in the surprise of admiration, for, Italian though he be, he has made an excellent study, and no one can look at that face without feeling proud and grateful and reverent; but it is possible to have too much of a good thing, and judging from the every conceivable material in which the “first in war, first in peace, and first in the hearts of his countrymen” is represented to us by foreign artists and artisans, one would fancy that we are a people who have never known the first president except by the page of history and the musty records of politics.

But it will not do to stand gazing at this, or turn to look at Pozzi's marble of Michael Angelo, seated, and working at a head, or stare in fascination at the duplicates in bronze of Rossetti's “Steam” and “Electricity,” or marvel at the verisimilitude of Livingstone's statue in bronze, but let us pass into the departments of



"The Great Exhibition, 1876."

SUNDAY IN DEVONSHIRE.

By A. F. Bellows.

[The Art Gallery.]

the various countries, and take our readers with us as we look

for such pictures as are worth remembering, and if possible studying.

Naturally we turn to the American department,* and as we do so we think of the period, not so far distant, when, being in its infancy, there were few representatives of this signification of civilization; but new as is our country it furnished the parent country with Benjamin West upwards of a century ago. Here are two of West's most famous pictures—"Christ Blessing Little Children," in the English department, and his "Death of General Wolfe"—the latter loaned for this Exhibition by Queen Victoria.

The "Death of Wolfe" is one of his most striking pictures; it is noble, natural, and a subject for which his nationality qualified him particularly. In the picture he has introduced his old friends—those who are said to have taught him the secret of the mixture of their war-paints—the red Indians—strange and picturesque beings to those English who first saw this grand picture. We present on page 22 an engraving of the "Death of Wolfe." The picture itself is in a good state of preservation. It was first exhibited at the Royal Academy, where it was admired and received with acclamation. When it became known that he was painting this picture in the unclassic manner with boots, buttons and blunderbusses—the characters as they had actually appeared on the scene, and not naked warriors with bows, buckles and battering-rams—the Archbishop of York and Sir Joshua Reynolds called at his studio to expostulate with him at this departure from the conventional manner, and to declare that it would ruin his prospects as an historical painter; but the picture was now well advanced, and West adhering to his opinion, Sir Joshua seated himself before the picture, examined it with deep and minute attention for half an hour, then rising, said to the Archbishop, "West has conquered: he has treated his subject as it ought to be treated. I retract my objections; I see that this picture will not only become

*As it would be inconvenient to do the departments in the two divisions where the exhibits are divided between the Art Gallery and the Art Gallery Annex, we shall finish completely one country's exhibit before taking up another.



"The Great Exhibition, 1876."

NEW YORK HARBOR: MOONLIGHT.

By Edward Moran.

[The Art Gallery.]

popular, but will occasion a revolution in art." When this reached the ears of our enemy, George III, "I wish," he said, "that I had known all this before, for the objection has been the means of Lord Grosvenor's getting the picture, but West shall make a copy for me;" and West made the "copy" which has descended to his successor, Queen Victoria, and thousands of Americans have had the privilege of looking upon a picture by the first great American artist, which verified Sir Joshua Reynolds' prophecy.

The outline of West's life is so well known to the public that it would be a work of supererogation to furnish those details—although they do not come within the scope of our work; but his artistic life is unfortunately not so familiar in our memories, and if some good biographer would do this work he would be rewarded by producing a charming book—almost romantic—and the public would discover a new source of enjoyment. We shall finish this with an anecdote of West, which will give an insight to his youthful character and ambition.

In the ninth year of his age he accompanied his relative, Pennington, to Philadelphia, and executed a view of the banks of the river, which so much pleased a painter named Williams that he took him to his studio and showed him all his pictures, at sight of which he was so affected that he burst into tears. The artist, surprised, declared that Benjamin would be a remarkable man. He gave him two books on Painting, and invited him to call, whenever he pleased, to see his pictures. From this time Benjamin resolved to become a painter, and returned home with the love of painting too firmly planted to be eradicated. His parents, too, though the art was not approved by the Friends, now openly encouraged him, being strongly impressed with the opinion that he was predestinated to become an artist. His notions of a painter at this time were also very grand, as the following characteristic anecdote will show. One of his school-fellows allured him, on a half holiday from school, to take a ride with him to a neighboring plantation. "Here is the horse, bridled and saddled," said the boy; "so come, get up behind me." "Get up behind you!"



[The Art Gallery.]

RETURN OF THE HERD.

By Peter Moran.

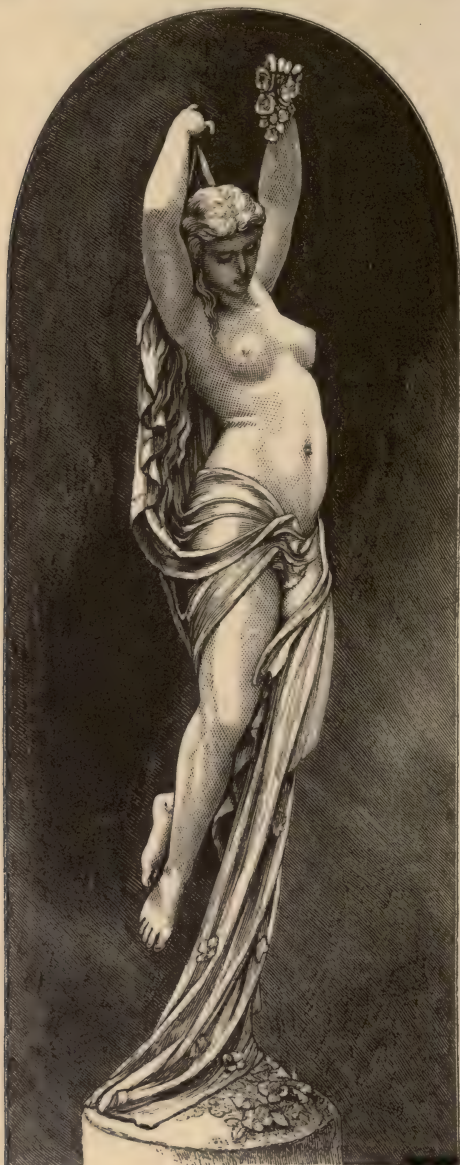
“The Great Exhibition, 1876.”

said Benjamin; "I will ride behind nobody." "Oh, very well!" said the boy; "I will ride behind you; so mount!" He mounted accordingly, and away they rode. "This is the last ride I shall have for some time," said his companion; "to-morrow I am to be apprenticed to a tailor." "A tailor!" exclaimed West; "surely you will never be a tailor?" "Indeed but I shall," rejoined the other; "it is a good trade. What do you intend to be, Benjamin?" "A painter." "A painter! What sort of trade is a painter? I never heard of it before." "A painter," said West, "is the companion of kings and emperors." "You are surely mad" said the embryo tailor, "there are neither kings nor emperors in America." "Aye, but there are plenty in other parts of the world. And do you really intend to be a tailor?" "Indeed I do; there is nothing surer." "Then you may ride alone," said the future companion of kings and emperors, leaping down; "I will not ride with one who is willing to be a tailor." This was a hundred and thirty years ago.

West's family were descended from English settlers and farmers, and were Quakers by persuasion. Reared in a sect which abjured painting as a worldly and sensual art, the lad's promptings to the practice of painting had no outer aid, and were pursued in spite of the remonstrances and admonitions of the Friends, though it does not seem that his father and mother opposed his exercise of the gift which he had received. It is said that some Indians, who had imparted to him the secrets of the mixture of their war paint, were his first teachers, to their red and yellow his mother added indigo, and his brush he made from hairs cut from the cat's back. A council of neighboring Quakers, called together to decide on the question of young West's infringement of the rules of the sect, agreed wisely and reverently that God would not bestow faculties and forbid their employment, and gave West permission to follow his calling. The women rose and kissed him, and the men one by one laid their hands on his head, a solemn dedication which he never forgot.

Having studied under Williams, West tried portait painting, first in Philadelphia, and afterwards in New York. He was then

but twenty years of age, and in his twenty-second year, 1760, his



"The Great Exhibition."]

AURORA.

J. A. Bailly, Sculptor.

[The Art Gallery.

ambition and discretion led him to travel to Italy, where he studied for three years. His intention was to return to America,

and merely to visit England on his way home; but on his arrival in London he found his prospects there so promising, that he sent for the young American girl to whom he was engaged, married, and settled with her in the old country, in his twenty-seventh year, 1765.

The Archbishop of York presented West to king George III, who took a violent fancy to the young man, quiet, steady, and domestic, as the king himself. George's not very intellectual or artistic taste imagined that he had discovered—with all the glory of the discovery—a great genius. The American war did not shake the king's fidelity to his protégé. George III's almost entire patronage was thenceforth given to Benjamin West. The royal regard, thus exclusive, was viewed with lively indignation by many other painters, with claims to notice, but struggling for bread, while West was receiving from royal commissions, for a period of thirty years, sums at the rate of a thousand pounds a year—then considered a large income to be derived from art. Neither was the king's exclusive patronage beneficial to Benjamin West himself as an artist, though as a man he remained the simple, unpretending, kindly man he had come to England. He soon renounced portrait painting for historical and religious painting, and the constant demands made on his imagination, together with the absence of any stimulating competition or anxiety with regard to worldly success, and perhaps—unassuming man though he was—in consequence also of the constant sops administered by royal favor, to his self-satisfaction, West's invention became wearisomely dull and tame.

After the king fell sick, and when West was left more to his own resources, he seemed to take a new start in his art, and his "Christ Healing the Sick" and "Death on the Pale Horse" are much valued. West was one of the first thirty-six members of the Royal Academy, and succeeded Sir Joshua Reynolds as president, retaining the office till West's death, at the age of eighty-two years, in 1820.

Another American had arrived in London to dispute the palm of victory with the English painters. John Singleton Copley was

born at Boston, in 1737. He went to England in 1774, and after visiting Rome, settled in England in 1775. Like West he had been a portrait painter, and, like him also, Copley adopted historical painting as his chosen branch of art. Like West still, and very unlike Barry, or the later British historical and imaginative painters, Copley had a prosperous history. He was fortunate in taking for his first historical work a contemporary scene, which made a deep impression on the English nation—"The Death (or rather the death-blow) of Chatham in the House of Lords." Popular as this picture became through engravings, it was inferior to a later work



"The Great Exhibition."]

CINDERELLA. [Art department of Women's Pavilion.
Blanche Nevin, Sculptor.

of Copley's—"The Death of Major Pierson" (in the rescue of the island of Jersey from the French)—which is regarded as superior to West's "Death of Wolfe." Copley introduced successfully portraits into his historical pictures.

In character, Copley was industrious, painstaking, and unobtrusive. He died full of years, and having attained an honorable independence, in his seventy-ninth year, in 1815, and left a more distinguished son—the great barrister and chancellor, Lord Lyndhurst, who continued for many years to reside in his father's old house in George Street, Hanover Square, where many of the

painter's works were retained and cherished. As a historical painter, Copley, while a far less cultivated artist, is said to have been fresher and more original than West.

A contemporary of West, and belonging to the generation just before that of Leslie, Washington Allston was born in 1779, at Waccamaw, South Carolina. His father was a planter. As young Allston's health was delicate, and his father's plantation remote, the boy was sent for physical bracing and for mental training to Newport, Rhode Island. He remained there for ten years.

According to Mr. Tuckerman, one of the earliest impulses to American art was given in New England by the first visit of an English painter of note with Dean Berkeley in 1728, together with the influence of the painter Gilbert Stewart, who was connected with Newport.

Allston's boyish intimacy with Malbone, afterwards a well-known miniature painter, seems to have turned his attention to art. The two friends went together to England in 1801, when Allston was twenty-two years of age. He became at once a student of the Royal Academy, of which his countryman West was President. According to Allston himself, his favorite subjects were then banditti, and he was more than a year in England before he got over the mania. When he made known his purpose of becoming a historical painter, he was told by Fuseli—"You have come a great way to starve." Allston remained for three years in London, receiving great kindness from West, and having for the chief of his many friends Moore, the author of "*Zeluco*," and Fuseli. In 1804 he visited Paris along with another American painter, and after studying the accumulated treasures of the Louvre while they were yet intact, proceeded to Italy, where he spent four years, for the most part in Rome. There he met the sculptor Thorwaldsen and the poet Coleridge, and entered into a lasting friendship with them, while, like Leslie, he profited by an intimate companionship with their countryman, Washington Irving.

Washington Irving describes Allston as being then a singularly attractive young man. "Light and graceful" in figure, and "with

large blue eyes, and black, silken hair, waving and curling round a pale expressive countenance. Everything about him bespoke the man of intellect and refinement." Allston gave Irving good advice while they were visiting in company the Roman galleries—"Never attempt to enjoy every picture in a great collection unless you have a year to bestow upon it. You may as well



[The Art Gallery.]

IN THE BAY OF NAPLES.

By F. D. Millet.

"The Great Exhibition, 1876."

attempt to enjoy every dish at a Lord Mayor's feast. Both mind and palate get confounded by a great variety and rapid succession even of delicacies." While Allston was in Italy foreigners called him "the American Titian."

He returned to America in 1809, when he was thirty years of age, and married a sister of Dr. Channing's, but did not then settle in his native country. He started afresh for England, where, in spite of Fuseli's former warning, his first exhibited picture was from sacred history, and was "The Dead Man Revived." The painter had the satisfaction of receiving from the British Institution their prize of two hundred guineas for historical painting, and of having his picture bought and transported to his own country by the Pennsylvania Academy. His next picture was ordered by Sir George Beaumont, and was "St. Peter liberated by the Angel." Two other pictures were "Uriel in the Sun," now in the possession of the Duke of Sutherland, and "Jacob's Dream," which is in the collection of Lord Egremont at Petworth. The British Institution awarded the painter the sum of a hundred and fifty guineas for "Uriel in the Sun."

At this time Allston, while working hard to the overtaking of his strength, found ready and liberal purchasers for his works, and was surrounded by congenial friends, among them young Leslie, who lived for some time in his house.

While in this prosperous and happy condition he was suddenly afflicted with the loss of his wife, and his health and spirits were so affected that he returned to America, in 1818, when he was in his fortieth year. He carried with him only one completed picture, that of "Elijah in the Wilderness," which was subsequently bought and brought back to England by the Hon. Mr. Labouchere. About this time the Royal Academy, London, showed the respect in which they had held Allston by electing him a member of the Academy.

Allston resided twelve years in Boston, where he painted "The Prophet Jeremiah," "Saul and the Witch of Endor," "Miriam Singing the Song of Triumph," and "Dante's Beatrice." In 1830, Allston, in his fifty-second year, married for his second wife, a daughter of the late Chief Justice Dana of Cambridge, Massachusetts, and removed his studio to Cambridge, where he spent the rest of his days, which were those of an invalid, painting when

he could, and leading a life of great seclusion, though he enjoyed the society of a few friends and the visits of painters and lovers of art, among them Lord Morpeth and Mrs. Jameson.

Allston was a man of earnest religious faith, great conscientiousness, and high ideas with regard to the aim and end of his



"The Great Exhibition, 1876." "YOUR GOOD HEALTH!"
By F. W. Champney.

[The Art Gallery.]

profession. Mr. Tuckerman tells us that the painter, "when crippled in resources in London," had sold a picture for a considerable sum, but that it occurred to him, after the sale, that the subject might have an evil effect on a perverted taste and imagination, when he instantly returned the money, and regained and destroyed

the picture. He would relate "with much solemnity," how on one occasion of keen deprivation and discouragement his prayer was answered as soon as uttered. He was a man of large sympathies, calling himself with justice "a wide liker." He was generous and kind to young artists, who were fond of styling him "the Master." In those later days Allston was still distinguished by his personal advantages, though they were altered in kind. His slight active figure had grown spare, his eyes looked yet larger and more speaking under his broad brow, while his long hair had become white as snow.

In 1836, when he was in his fifty-ninth year, Congress invited him to fill one of the panels in the Rotunda of the Capitol at Washington, but he declined the commission. An exhibition of his pictures in Boston, to the number of forty-two was made three years later.

Allston's mind had been set on a long-projected, long-worked-at picture. During his second residence in London he had begun a great picture of "Belshazzar's Feast." But many circumstances—among them delicate health and pecuniary embarrassments, which caused at one time the arrest of the unfinished picture—delayed its progress. For nearly forty years Allston worked at intervals on this picture. In 1842 he had painted at it steadily for a week, when on the Saturday night, after an evening's thoughtful pleasant intercourse with his family, the painter suddenly but gently expired from an attack of heart complaint, to which he was liable. At the time of his death he was in his sixty-fourth year. He was buried by torch-light at Cambridge.

Twenty plates, the largest twenty inches by thirty, of outlines by Allston, were published a few years ago; they were selected from compositions hastily sketched in chalk with outlines in amber.

The United States in its infancy as a republic offered little temptation to her own sons—either as a field for study or as appreciative of any branch of the art, except portrait painting; and most of her sons had to proceed to Italy or France, and on returning to the land of their nativity by the way of England

were generally induced to stay in London where they felt and received more encouragement than could be expected from a young Republic with no accumulated wealth, and hard work with the



[The Art Gallery.]

THE LAST STRUGGLE.

By W. M. Brackett.

[The Great Exhibition, 1876.]

soil. Although not born in America, yet of American parentage, his father and mother having been born in Maryland, whilst he was born in London, whither his parents had taken a voyage on

business. We find in the English department one of Charles Robert Leslie's pictures, "May-day in the time of Queen Elizabeth," of which we give an engraving on page 24. This is the only specimen, we think, of Leslie in the Exhibition, and pity that is so; for irrespective of the tastes of art lovers, there are very many of our veteran army officers who would have liked to see more work in the higher branch of art by their old drawing-master at West Point. Leslie lived a somewhat eventful career; his father was engaged as a painter and clockmaker in Philadelphia, but before Charles was born, he went *en famille* on a voyage to England.

On the occasion of their visit, which was of several years' duration, Charles Leslie was born. The watchmaker and his family returned to Philadelphia, and after a voyage of more than seven months, he found that his affairs had fallen into great disorder, a discovery of which caused his death, leaving Leslie, not ten years of age, the eldest of a young family under the charge of a widowed mother. The widow opened a boarding-house for the support of her family, while her eldest daughter went out as a drawing teacher. The professors of the college at Philadelphia admitted the young Leslie lads to the college classes at reduced fees, and uncles and aunts, who had comfortable and pleasant farmers and millers homesteads on the Brandywine, welcomed the boys with homely kindness, for the summer holidays.

At fourteen years of age Charles Leslie was bent on being a painter, but by the anxious care of his mother he was apprenticed to a firm of booksellers and publishers, to the head of which his apprentice's ineradicable propensity for art at first gave little satisfaction. Eventually, however, the man of business afforded liberal assistance to his subordinate.

The occasion of the visit of Cooke the tragedian to Philadelphia, when the bookseller's apprentice was able to make a telling sketch of the actor, caused the kindly conversion of the master to the lad's art-interest. By the aid of the business men who attended the Exchange Office House, Leslie was enabled to proceed to Europe to prosecute his studies. He went to England in 1811,

when he was seventeen years of age, bringing, of course, letters of introduction to his countryman, West.

Leslie and another American lad, two years older, took lodgings



"The Great Exhibition, 1876."

THE LITTLE SAMARITAN.

J. S. Hartley, Sculptor.

[The Art Gallery.]

together, and started, by devoting "their days to painting, and their evenings to the Royal Academy," to which Leslie was admitted a student in 1813, when he was in his twentieth year.

As a farther advantage the studios of West and of Allston, then in London, were opened to Leslie. He was permitted to see his seniors' work in progress, and was encouraged and helped by their advice and friendship, for the lonely lad had brought with him the cheerful, amiable temper, as well as the enthusiasm for his profession, which had so speedily broken down opposition, and procured him influential friends beyond the Atlantic. He studied the Townley Marbles in the British Museum, and rose at six in the morning to accompany his companion to Burlington House, to join him in the study of the Elgin Marbles then lodged there. For Leslie put little value on any outside help which was not supplemented by personal diligence; indeed, he went so far as to deprecate all education save self-education, and was wont to speak of the "wise neglect" of Fuseli which made such men as Wilkie, Mulready, Etty, Landseer, and Haydon, and did not render them "all alike by teaching."

In order to gain an immediate livelihood, Leslie practiced portrait painting; he was also induced, probably by the example of West, to try high art, in "Saul and the Witch of Endor;" but he very soon, almost as soon as Wilkie, found his proper vocation in genre painting. In 1817, when Leslie was twenty-three years of age, he visited Paris, Brussels, and Antwerp, studying the old masters. This was one of Leslie's few visits to the continent.

As early as 1819, when Leslie was no more than twenty-five years of age, he painted for an American merchant, and exhibited in the Academy, his "Sir Roger de Coverley going to Church," which was at once received with great approbation—making his way clear. This was the first of a long series of pictures peculiarly acceptable to the public, because they were spirited and lovely illustrations of popular subjects, and both illustrations and subjects, while they were certainly not below, were, with equal certainty, not far above, the general intelligence of a fairly cultivated public. A list of Leslie's best-known subjects will show my meaning: "May-day in the reign of Queen Elizabeth;" "Sancho Panza and the Duchess;" "Lady Jane Grey prevailed on to accept the Crown," (in this instance

their is a slight departure from the usual rôle, for you will observe that Leslie's subjects, while moderately intellectual, are for the most



"The Great Exhibition, 1876."

1776.

By G. W. Maynard.

[The Art Gallery.

part cheerful as his own temper, and not even darkened by the shadow of a tragedy); "Dinner at Page's House;" "Uncle Toby and the Widow;" a steel engraving of this latter is exhibited by the

engraver. Leslie's intimacy with Washington Irving, whose "Sketch Book" Leslie illustrated, is judged, probably with perfect correctness, to have been the influence which directed the painter to the pages of Addison—greatly admired by Washington Irving—for inspiration, since Leslie drew his inspiration mainly from books. And such characters as he painted from "the Spectator," "Don Quixote," and "the Merry Wives of Windsor," &c., have for the most part an acceptance which is widely acknowledged.

Leslie corresponded regularly with his American relations, and for a time looked forward to his return to America, but his art friends and his good prospects in England proved too strong for this intention. In 1821, when he was twenty-seven years of age, Leslie was elected an associate of the Academy, and five years later he became a full member. The accident of his taking the place of another painter summoned hurriedly to sketch the features of a dying child introduced Leslie to the pictorial glories of Petworth, and the friendly patronage of Lord Egremont, for whom he painted "Sancho Panza in the apartment of the Duchess," one of the most admired of Leslie's pictures, and one which secured his wordly success, enabling him to make in 1824, at thirty years of age, a happy marriage with a young English beauty, belonging to a bevy of six sisters, named Stone, whose personal charms provoked their grotesque classification by some would-be wit of their circle, as "the six precious Stones."

But though Leslie was settled in England and married to an English wife, he did not lose his American sympathies. He was given throughout his life to fast friendships, which even influenced his art, and his greatest friends for years were his countrymen—the pleasant, witty author, Washington Irving, and the clever, vain, hare-brained painter, Newton, to whose ability in coloring Leslie's inferiority in that respect owed improvement. The three young Americans seem to have been inseparable, visiting together in a circle of Americans resident in that country, frequenting the two studios, running off in a trio on light-hearted expeditions, dining many a time frugally, but merrily, at the York Chop House, in



[The Art Gallery.

WHEELWRIGHT'S SHOP.

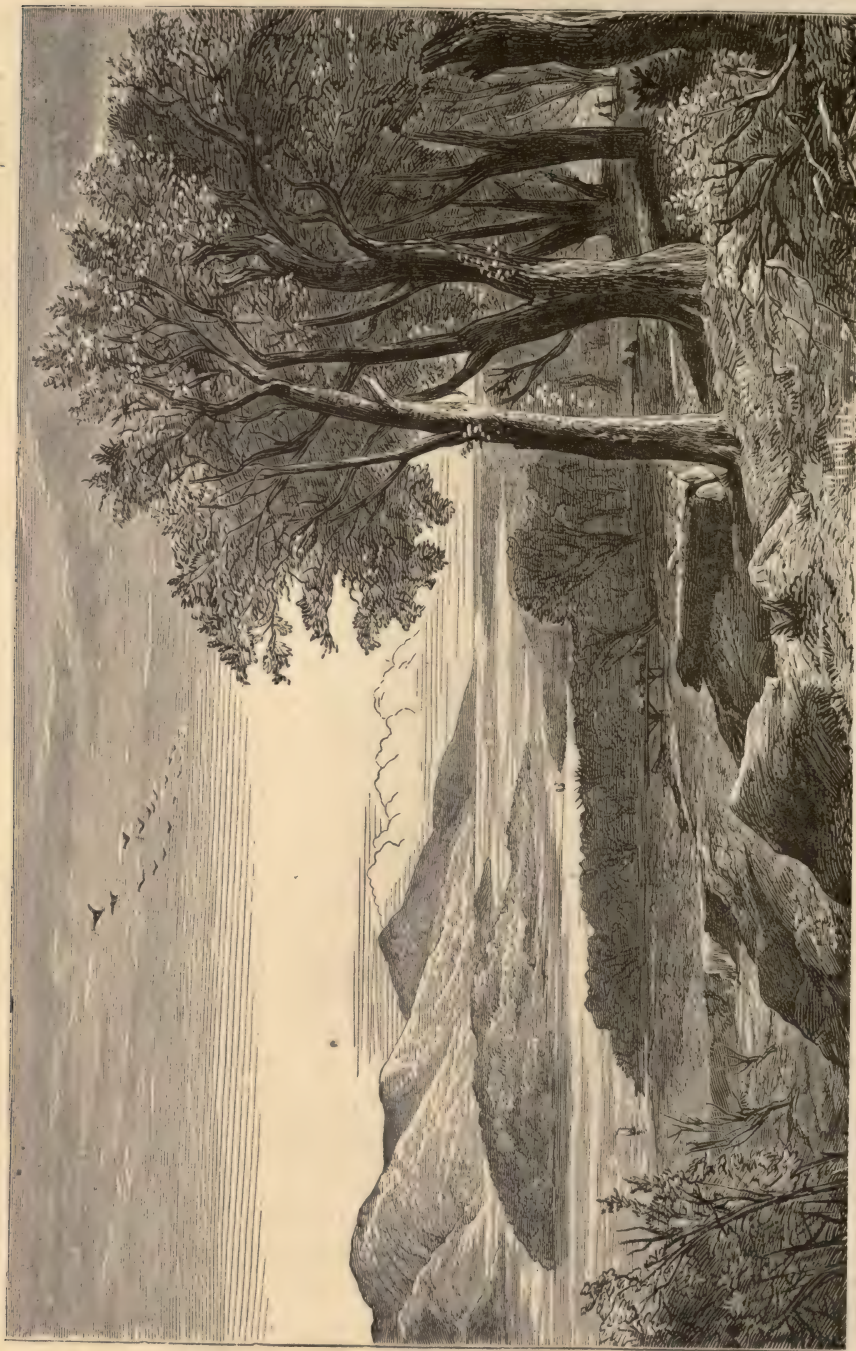
By E. T. Biddings.

"The Great Exhibition, 1876."

Wardour Street, where generations of young painters have, in succession, been served.

But Leslie did not need to go beyond his own home for peace and relaxation. He was a man of domestic tastes and warm affections, and in his wife, with their children, to whom he was tenderly attached, rising round him, he found the sweetest solace after work, as well as one of the best incentives to honorable ambition. But the interests of these children, and the strength of old ties, broke up his English home for a time, and tempted Leslie to revive his old project of returning to America.

In 1833, when the painter was nearly forty years of age, he accepted the appointment offered to him by the American Government of Professor of Drawing to the Military Academy of West Point, on the Hudson, and made the somewhat rash venture of resigning his known and fair opportunities in England, for a return to long left interests and new and untried resources. The experiment did not prove successful. His duties were irksome, his English wife did not like America, the very climate seemed to the naturalized Englishman to have undergone a change from the days of his hardy boyhood, and within the short space of six months Leslie returned with his family to his adopted country. The brief leave-taking and coming back, form two of the principal events in Leslie's happy and prosperous career. Short as the interval was during which they occurred, it included the catastrophe of the declared insanity of poor Newton the painter. In the room of the regard whose object had passed beyond its reach, Leslie developed a faithful friendship—not the less affectionate on account of the ruggedness of the friend—for Constable the painter, who in his turn exerted a marked effect on the sympathetic mind of Leslie, and thenceforth Constable's cool greys and vivid greens became prominent where Newton's brilliant rainbow hues had prevailed in the chosen interpreter of Cervantes, Sterne and Shakespeare, in their lighter scenes. In 1838, Leslie painted for Queen Victoria her "Coronation," in which the maiden queen, and the fair young members of the English aristocracy figure very gracefully. In 1841, he executed a similar commission, with the "Christening of the Princess Royal" for his subject.



"The Great Exhibition, 1876."

LAKE GEORGE.

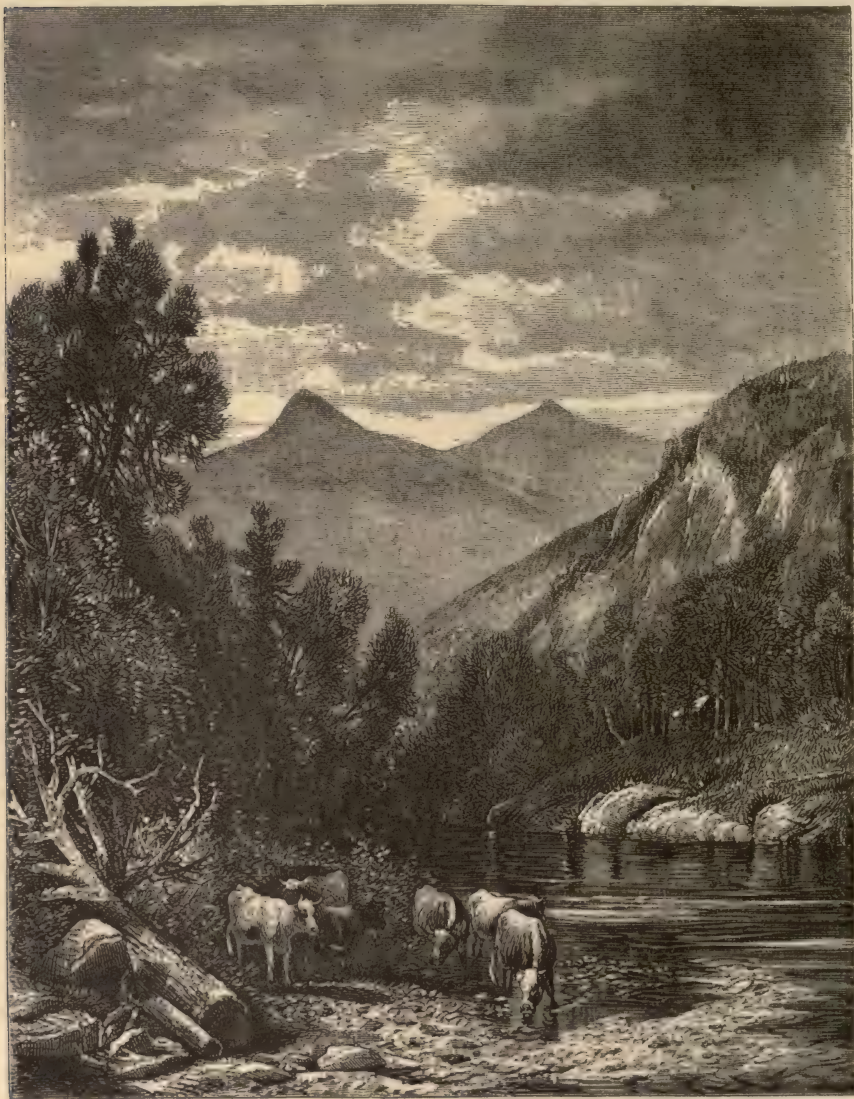
By J. F. Kensett.

[The Art Gallery.]

Leslie was elected Professor of Painting to the Royal Academy in 1848, and held the appointment till failing health forced him to resign it in 1851. Leslie's much-loved children, both while young and after they had grown to manhood and womanhood, are said to have supplied him with many a hint for childish playfulness, girlish shyness, and the elastic vigor of young manhood. The death of one of these children, a cherished daughter and young bride, who faded suddenly and died in her early prime, is said to have proved at last Leslie's death-blow. She died in March, 1859. Her father, after struggling in vain with his depression, sank of a complaint, from which no fatal result had at first been apprehended, and died in his house in St. John's Wood, London, in the May of the same year, 1859, aged sixty-four years. On a slip of paper attached to his will Leslie had written, "I trust I may die as I now am, in the entire belief of the Christian religion, as I understand it from the books of the New Testament, that is, as a direct revelation of the will and goodness of God towards the world by Jesus Christ, the Saviour and Judge of the world." Leslie has left a successor to his name and art, whose nymph-like maidens are a farther development of the love of the beautiful.

Leslie's merits as a painter seem to belong largely to the well-balanced, sunny, humorous nature of the man. His defective art education was never altogether supplemented; he owed little or nothing to foreign study; and he seemed to draw well rather from his innate sense of harmony, grace and beauty, than from accurate knowledge. He was deficient as a colorist. He used simple modes and mediums in mixing his colors; and there was one advantage in the medium (which was in the end pure linseed oil,) that it has kept his pictures in good preservation. He did not paint landscape well. His sphere, or else the taste of the public where he was concerned, was so limited, that even when he diverged from Sterne to Swift, or ventured on such an innovation as painting "Lady Jane Grey prevailed on to accept the Crown," or "Columbus and the Egg," his judges held that he

had overstepped his powers, and that there was a falling off in his attainment. Yet few modern painters have given greater de-



"The Great Exhibition, 1876." **KEENE VALLEY, ADIRONDACKS.**
By Thomas Hart.

[The Art Gallery.]

light than Leslie gave. He was so good within his range. His sense of beauty was very true, and very pure and delicate as well

as true. His appreciation of humor must have been equally keen, while his good sense and good taste prevented him from being guilty of the least exaggeration or burlesque in his representations of what was comedy and not farce. He could do what seems a rare endowment in modern days, draw a nice line between comedy and farce.

A cotemporary art-critic says of "Sancho Panza and the Duchess":—"How lovely is the Duchess; how perfectly at her ease, how truly one of Nature's gentlewomen, as she sits listening to Sancho's tale. What a round, full form! The light of a happy smile in her eyes; the amused satire of her dimpling mouth, pleased at the simplicity of the peasant squire, who takes her into his confidence, and binds her to secrecy as to his master's escapades, putting his finger to his nose as he tells his tale. Contrasted with the rare beauty of the lady, and serving as its foil, is the stately frigid duenna, drawn up to her full height, her hands crossed in front, her keen, observant eye seeing all that is going on, but no smile is ever likely to twinkle there, nor to part her thin, dry lips. What a contrast to the laughing black damsel on the opposite side of the picture, who grins and shows a mouthful of teeth, at the unconscious assurance of the garlic-loving Sancho in relating his adventures to her noble mistress." A steel plate engraving of this picture is exhibited.

Another American artist, but naturalized, is Emmanuel Leutze, whose picture of "Washington Crossing the Delaware" is world-known, was born in 1816, at Emingen, near Reuthingen, in Wurtemberg. His father was a German mechanic, who was induced by political discontent to quit Europe and settle in Philadelphia. Young Leutze sketched from his boyhood. In 1841, when he was twenty-five years of age, he got enough orders for his work to enable him to visit Europe. Naturally as a German, he turned his steps—not to the special American art-bourne, Rome, but to Düsseldorf, where he entered the Academy. He soon won a name in historical painting, his picture of "Columbus before the Council of Salamanca," being bought by the Art Union of Düsseldorf, and commissions followed him from his adopted country.

From Germany Leutze proceeded to Italy, returning to Germany and marrying there the daughter of a German officer, but still retaining the strong sympathy of Americans by painting, while resident in Germany, a series of pictures with subjects dear to



"The Great Exhibition, 1876."]

THE REPROOF.

By Emily Sartain.

[The Art Gallery.

American hearts—such as "News from Lexington," and "Mrs Schuyler Firing the Wheat Fields." In 1859, when Leutze was forty-three years of age, he returned to the United States, while he left his family for a time in Germany. In 1863 he went to Düsseldorf to fetch his family, having found a great change in

the prospects of American art, so that it now offered a fair field for an historical painter.

Leutze's pictures are full of action, and he has sought for dramatic inspiration in American, Spanish, French, German, and Scotch history. Among his best known pictures are his "Landing of the Northmen," his various "Columbuses," his "John Knox and Mary Stewart," and his "Cromwell and his Daughters." Leutze painted for the panel of the south-western staircase in the new wing of the Capitol at Washington—"Western Emigration." A great emigrant party, travel-stained and weary, arrived on the rolling prairies, of which the Rocky Mountains are the back-bone, with a border enriched by allegory and emblem, in true German style. The picture is painted by the stereo-chromatic or water-glass process, that seems to be taking the place of the old fresco painting. For the "Columbus in Chains," which was sent to the great Brussels Exhibition, Leutze received from the king of the Belgians the medal *à vermeil*, as a *recompense nationale*.

The marble statue of Washington on the pedestal opposite Judges' Hall, was sculptured by Gianfranchi after the figure in Leutze's picture of "Washington Crossing the Delaware."

We see few other specimens of the older American school of painters. Page, of Albany, the "American Titian," is represented not in this gathering of the land of his birth; and no possessor of any of the masterpieces of sculpture by Hiram Powers has chosen to do honor to the dead artist, by exhibiting some of his marvellous genius; this might have been done, for we observe Mr. Naylor of England has risked a replica of Venus, by another dead artist, John Gibson. Was there no man so rich as to do honor to Hiram Powers?

A contemporary of Allston's, and a connecting link between deceased and living American artists, is Daniel Huntington, who exhibits several of the finest pictures in the American department. He was born in 1816, in New York.

From the four or five pictures which he exhibits, we engrave on page 64, his "Sowing the Word," a quiet and thoughtful picture,



"The Great Exhibition, 1876. "]

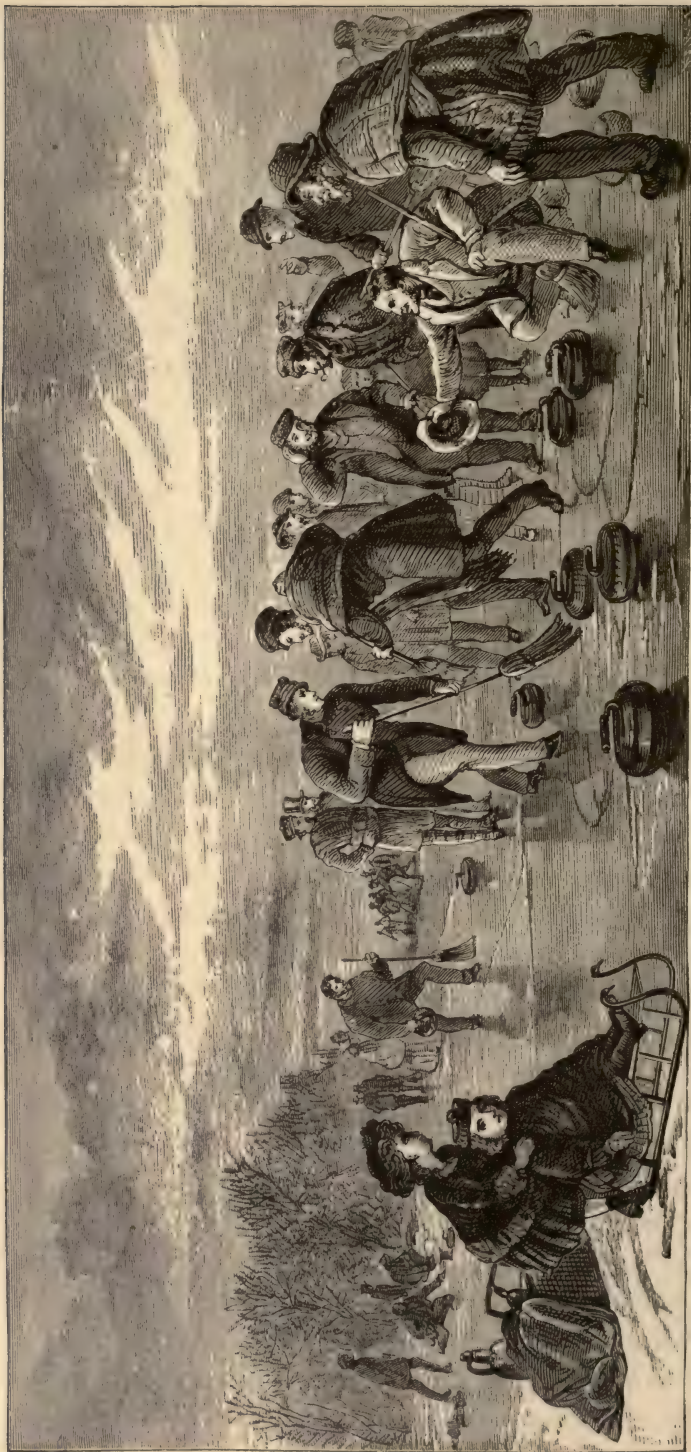
RUTH.

R. Rogers, Sculptor.

[The Art Gallery.

subdued in its tone—almost characteristic of the painter, an unassuming gentleman, with a considerable appreciation of humor. His aim is sober and manly, rejecting alike violent efforts at dramatic effect and minute drudgery of elaboration.

The walls of the corridor leading to the American and English departments are hung with the work of American artists. An eminent family of painters are the Morans. An attractive painting by Mr. Edward Moran, of New York, copied in the large engraving which we present on page 28, shows that superb and starry spectacle of the land-lights of America, which first causes the immigrant's eye to dance with hope and his heart to swell with ambition as he comes to conquer his opportunity among the free. Here is the city spread between the mouths of the Hudson and East rivers, here is the dull and ponderous fortification on Governor's Island, all pierced and pricked with twinkling lights like a fairy scene in the theatre. How many sturdy men have looked upon the inspiration of these lights with irrepressible tears! For how many has the pause at Sandy Hook, the debarkation at Castle Garden, meant success, opportunity, renown even, in contrast with the certain continuance of degradation in that darker and older world! The able and successful men we can reckon around us, the public men who have risen to command, have in a surprising number of instances been taken from the ranks of those strong, muscular, serious, plain men whom we see idling around the walks of Castle Garden in the first day of their unaccustomed liberty, waiting to "take occasion by the hand." Such are the seed of the new earth. To-day they are of the million—to-morrow of the millionaires. To-day they are nobodies, rocked over the flashing waves of the Bay into the embrace of that twinkling crescent of lights: soon they are individuals, entities, sovereigns, with every chance to conquer the esteem of their kind by power, wealth, or intellect. This is the sort of legend that seems to be whispering forth out of the rippled waves and rolling moon of Mr. Moran's picture, a fine augury to greet the subjects of European monarchs as they face it. The painter, a man of self-made progress in art, belongs to a



"The Great Exhibition, 1876."

CURLING IN CENTRAL PARK, NEW YORK.

By J. G. Brown.

[The Art Gallery.]

family of brothers who are all curious instances of inborn talent and perseverance conquering a success among the American people, so hospitable to ideas. Mr. Edward Moran and his brother Thomas have enjoyed the advantages of an Americo-British art-education: they have profited almost as much by the English artist Turner as by the American artist Hamilton. Thomas Moran—about equally known by his fine “Yellowstone” scene in the Capitol at Washington, as by the remarkable book-illustrations which he scatters from his home at Newark to the best magazines and art-publications of the land—can be judged in the Exhibition by five landscapes in widely-separated styles. The “Dream of the Orient” plainly shows his extraordinary admiration for Turner, of whose works he has made so many copies of the rarest fidelity; while “The Mountain of the Holy Cross” is more in the style of his monumental works at the Capitol.

Another brother, Peter Moran, is an accomplished practitioner in the more difficult line of cattle and figure painting; while a younger one, John, is one of the first topographical photographers in the country. By Peter Moran, the cattle-painter aforesaid, we engrave on page 30 the spirited subject, “The Return of the Herd.” In a pleasant rolling country near the Brandywine or the Wissahickon the herdsman and his dog are driving home the cows after the soft afternoon storm which makes the herbage so tempting for a lingering bite. Mr. P. Moran’s cattle are always obviously studied from nature. In the present picture, the black head of the central animal, relieved against the brightest sky where the storm breaks away, makes fine pictorial effect for the artist; and the pretty play of the near cow and calf is true to life. The four brothers we have named live in different cities, but their starting-point was Philadelphia, of whose academic art-training they are creditable alumni.

Prominent in the centre of the principal American Gallery there stands a lovely sculpture—“Aurora”—by Joseph A. Bailly. Our readers have but to glance at the illustration on page 32, to see that we shall not overestimate its beauties. Mr. Bailly exhibits,

besides his "Aurora" figure, which rises so white and mist-like, a portrait work of ponderous importance, the likeness of President Blanco, of Venezuela, recently set up in bronze at Caracas. Mr. Bailly, as a young Paris revolutionist exiled by the events of 1848, went over to England, where he wrought for awhile in the studio



"The Great Exhibition, 1876."

HIDE.

[The Art Gallery.

J. A. Rogers, Sculptor.

of his namesake, Edward Hodges Bailly, author of "Eve at the Fountain." Coming to this country, he attracted immediate attention by the skill with which he could carve and "undercut" the most intricate designs, and gradually rose to success as a sculptor of portrait and classical subjects. The technical ability of this

prolific artist is especially shown in all that relates to the mechanical portion of his art. The "Aurora," is a piece of magic; the equilibrium of the figure, whose feet are folded far above the ground, and who rises just over the trailing folds of a vail which merely sweeps the earth, is a powerful stimulant of our wonder. To have made such a device in bronze would be easy; but to carve it out of marble, when a false blow of the hammer would lay the beautiful image low at once, seems more than human skill could accomplish. Then the transporting of the critically-balanced figure in safety was a remarkable event, only to be brought about by a mechanical genius as conspicuous as the artistic. But Mr. Bailly has passed through the apprenticeship of every art that mechanics includes; and his marble vails and flowers and figure, light and perfect as a blossom on the stem, have been successfully removed—half standing, half overhanging—from the studio to the destined position in the far-away Park edifice. The image is like a crystalized mist from daybreak: "Aurora," only half disengaged from the Night, whose vail sweeps lingeringly from her forehead to the ground, holds and scatters upon the earth those blossoms whose petals are opened by the winds of morning, and whose blushes are copied from the blushes of the dawn. Such an evanescent idea ought to be sculptured in mist; but Mr. Bailly is able to give a mist-like tenuity to marble.

Another Philadelphia sculptor, a lady, Miss Blanche Nevin, who finished her "Maud Muller," in the atelier of Mr. Bailly, exhibits in the Fine art court of the Woman's Pavilion, her "Cinderella," which we engrave on page 34. At the Academy of Venice, and under the eye of resident Venetian sculptors, Miss Nevin received her best technical education. This artist is a sister of the Rev. Dr. Nevin, whose exertions in building a handsome church for American Protestants in the very heart of Rome were so creditable, and so quickly successful upon the triumph of the present government over the temporal power of the Pope. The lady is still quite young, but several of her figures in marble have been successful, as witness her "Maud Muller," and a subject owned by Mrs. Ste-

phens, the society queen. "Cinderella" sits with an air of discouragement among the ashes, in pose as if the Dying Gladiator had shrunk back into infancy and femininity. Dreams of the splendors and delights into which her luckier sisters have been



"The Great Exhibition, 1876."

SEEK.

By J. A. Rogers, Sculptor.

[The Art Gallery.]

admitted occupy her little head, while her own future seems as dry and cheerless as the faded embers. Cheer up, small Marchioness! In a moment the fairy godmother will appear, and you will escape from your marble and be a belle, and your tiny Parian foot shall be shod in glass, and the pumpkin shall roll with you,

and the rats shall gallop with you, and the Prince shall kiss your little mouth into warmth and color.

It is known that Boston has a Millet. Of course. France has a Millet—or had—the painter of peasant-groups, so original, so racy of the soil, so grimy, so similar to a chapter of Thoreau. England, too, has a Millais, pronounced just like the French, and equally the favorite of a certain inmost circle of the elect. These postulates being given, it was obvious that Boston must in the course of time, and that as soon as possible, have a Millet too. She has got one now, and nothing remains to complete her ambition.

Young Millet is a growing sapling, as yet in the developing stage, but, without joking, a young man of very decided promise. He sent to the National Academy Exhibition of 1876, a portrait of a lad, very frank, boyish, direct, and painted with engaging simplicity and robustness. We very decidedly like his *gondellied* in colors, entitled "In the Bay of Naples," and copied by us on page 36 from the original in the Centennial show. Who that has ever taken that primitive, antique sail from Naples to Capri in the old market-boat, would not warm to the picture of it, especially when executed with such freshness and wit? It is like a revived missing chapter from Pliny the Naturalist; behind our backs are the phenomena of that great volcano which cost the erudite Roman his life; before us the two-peaked outline of Capri lifting from the blue, and around us the peasant-life which has scarcely changed since the days of the ancients. Four of the mariners in this picture wear the Phrygian cap that Ulysses wore. They roll their arms and legs into the softest convolutions of the *dolce far niente*. They play with the handsome Anacapri girl on the seat that eternal game of dalliance and love which is never old. The bare-backed boys, opening and shutting their fingers like flashes of tawny lightning, play the immortal game of *Morra* which the Hebrew slaves played beneath the pyramids.

So drifting and floating, and letting the wind take care of the dirty old sail, they sit with their feet in a bed of fish, and execute

that delicious Capri-transit—the most luxurious bit of vagabondage,



A CHILD'S GRIEF.

R. Pereda, Sculptor.

set in the loveliest scenery, that even Italian life affords.

Two Bostonians, both Champneys, enlivened the American colony in France eight years or so ago—Benjamin, the elder, an old-fashioned landscape-painter, with a soul and heart eternally young, and a slim youth, J. W. Champney, who in those days lived in a very small and very lofty room in the Rue du Dauphin, and carried up his own milk in the morning for a home-made breakfast. Those days of student-liberty and independent fortune-fighting are over now, and as “Champ,” the young art-adventurer is famous. His illustrations to Mr. King’s work on “The Great South,” and his charming Centennial American sketches in a French journal, have won him admirers in America, England and France, and procured him compliments in more than one language. He contributes to the Exhibition, among other things, “Your Good Health!”, which we engrave on page 38. It is one of the small, single-figure subjects which Meissonier brought into vogue. A cordial old bachelor, who has seen life, and who wears the full-bottom wig and gaiters of the last century, is just lifting the glass filled from the tall champagne-bottle before him; a smile breaks on his mouth as the bead breaks on the rim. “Champ” has caught the freshness, the urbanity, the hospitality of his type, “and that,” as Nym says, “is the humor of it.”

Another Bostonian, Mr. W. M. Brackett, in a series one of whose subjects we engrave on page 40, has delineated “The Rise,” “The Leap,” “The Last Struggle,” and “Landed.” Here is the suggestion of country streams, hissing into foam over the shingly rock, and curling up into peaceful sleep among the boulders of the shore. The noble captive, his silver mail availing him nothing in this unequal warfare, writhes and twists his flexible body into a semicircle, exposing to the air his elegant tail and his panting gills, already half-drowned in the long race. It is the last effort for liberty; shortly will come the usual reward of unsuccessful heroes in a lost cause—the martyr’s fire, the approval meted too late to benefit the recipient, and the apotheosis—of the supper-table.

In the southwest pavilion stands a marble poem by J. S. Hartley, of New York. We have here a pretty maid of ten years, who,



"The Great Exhibition, 1876."

SOWING THE WORD.
By D. Huntington.

[The Art Gallery.

carrying the drink of the harvesters through the sunny field, has tempted a bird to taste it, as she stands silent and curiously watchful, with the cup in her extended hand. Is it water pure? Is it something stronger, such as harvesters love to taste behind the hedge? We do not know. The bird, shaking its wise, saucy little head with an air of doubt on the rim of the cup, shall decide for us. This however seems but a *bijoux* in comparison with the ponderous "Antietam Soldier," in granite, of which we give a steel frontispiece. Like the nation he defends, this colossus is in the bloom of youth, and like it he is hard and firm though alert. What art has succeeded in making this monster out of granite? He is twenty-one feet six inches in height. What sempster, working with needles of thrice-hardened steel, has draped him in those folds of adamant, that hang ten feet or farther from his inflexible loins? The sculptors of ancient Egypt, who had their colossi in granite also, worked for years with their bronze points and their corundum-dust to achieve their enormous figures, while the makers of this titanic image, availing themselves of the appliances of American skill, have needed but a few months to change the shapeless mass of stone into an idea. Something rocky, rude and large-grained is obvious still in this stalwart American; his head, with its masculine chin and moustache of barbaric proportions, is rather like the Vatican "Dacian" than like the Vatican "Genius." But, whatever may be thought of the artistic delicacy of the model, Mr. Conrads' "Soldier" presents the image of a sentinel not to be trifled with, as he leans with both hands clasped around his gun-barrel, the cape of his overcoat thrown back to free his arm, and the sharp bayonet thrust into its sheath at his belt. Rabelais' hero, Pantagruel, whose opponents were giants in armor of granite, would have recoiled before our colossus of Antietam, because his heart is of granite too.

The American heroes who have really succeeded in conquering the stubbornness of this mossy stone, and making it bend before them into the desired shape by the power of ingenious machinery, are the New England Granite Company, of Hartford. Before

their wonderful ingenuity the rock seems to lose its obstinacy; and, furnish them but an artistic model, they will translate its delicacy into the most imperishable stone.



"The Great Exhibition, 1876."]

HEBE.

After Canova.

[The Art Gallery.

What Mr. Conrads gives us in granite, Mr. George W. Maynard gives us—page 44, "1776"—on canvas. It is the same inflexibility, the same courage, the same mature will in stripling body; only

in Maynard's revolutionary hero these qualities are aggressive, while in Conrads' defender of the Union they are conservative. The figure in Mr. Maynard's "1776" is one of the "embattled farmers," a homespun patriot, bearing the standard that represented our Union before we had a flag—the pine-tree banner of Massachusetts, used as a device in the first battles of the Revolution, before the stars and stripes were invented. In his other hand he grasps the ancient musket—perhaps the very

"Old queen's arm, that Gran'ther Young
Fetched back from Concord—busted."

On the wall behind him is seen a placard, with fragments of the date, '76, and of the words "Union" and "Independence." This manly figure, in the picturesque "Continental" uniform, so rich in angles, gables, lappels, and *revers*, who crosses his gun-barrel over the standard he will only yield with his life, looks as sacred as a crusader. In his face of grief and valor we see the rankling wrong, the pressure of fate, that were the birth-throes of our nation. It is a face fit for a philosopher, transformed by events into that of a warrior.

And this observation leads us to interject the question whether any country ever yet begot a national type of face apparently able to do so much thinking and philosophizing as the American when at its best. The problem is whether the world yields an amount of thinking sufficient to equip the deep, brain-worn visages we see in all our national pictures, or in real life in the business streets of our cities. There is nothing else like them in the world. Compared with the American soldier's face, as defined from the testimony of all our artists and the very photographs of our officers, the faces of soldiers over the rest of the world are those of undeveloped intelligences; the Greek contestants of the Parthenon frieze are but large babies; the English soldiers of Hogarth's "March to Finchley" are good-natured, immature, beef-eating lads; the French soldiers of Vernet are dried out of all individuality—a tinder-box and a spark—a lean cheek and a glowing eye—food for powder, and then nothingness. But our ordinary American

phiz has a look of capability, of knowingness, and when handsome



"The Great Exhibition, 1876.")

PSYCHE.
By J. L. Mott.

{The Art Gallery.

of intellectual majesty, that it would take a vast deal of actual achievement to justify us in wearing. It is walking about under

false colors to adopt such faces unless we are really the philosophers, tacticians and diplomats of the age!

A really exalted sentiment of rural tranquillity is poured over Mr. Bellows's scene entitled "Sunday in Devonshire," engraved on page 26. It is the vibration of the church-going bell expressed in landscape-painting. We seem to see and breathe a different atmosphere from the work-a-day air as we mingle with these smock-frocked peasants on their way from church, appearing to have just received the blessing of Sir Roger de Coverley. Mr. Bellows is a young American painter who has passed much time in England, and whose works, both in oil and water-color, take an inspiration from English art rather than from that of the Continent. The spirit of English landscape, too, whose nutty honest flavor he seizes so perfectly, is a boon he has secured from a residence in the tight little island. It is not for him to soar into Colorado scenery or wrestle with the Yo Semite. The stage he loves is set with snug and crisp trees and happy cottages; sometimes he is familiar, and gives a kitchen-garden comedy for the benefit of Gaffer and Gammer; but when he is at his best, as in the present example, the limpid, translucent touches of his pencil transfer the very sentiment of "an English home," with the security, the hereditary calm, the

"Dewy landscape, dewy trees,
Softer than sleep; all things in order stored,
A haunt of ancient Peace."

Marine artists like Mr. E. Moran or Mr. M. De Haas characteristically find their pleasure in beating about New York Harbor. Day after day, in the fine summer weather, they may be seen standing, Columbus-like, on the prow of some vessel (which is more likely to be a grimy steam-tug than anything handsomer), engaged in their own peculiar kind of exploration. Their game is worth the chase, and the booty they collect justifies their taste. Other artists, like Mr. Brown in the picture we engrave on page 56, choose the freezing winter-time, and the frost-locked mimic sea

of Central Park. He has given us a careful and variously-dis-



"The Great Exhibition, 1876."

BEWARE!

By Forbes.

[The Art Gallery.

criminated crowd, mainly engaged in the noble old Scotch sport

of "Curling." The compatriots of Burns, among the hardest players and hardest workers of the age, have transported the game to this country, where it attracts every winter the delighted wonder of the ignorant and the incapable. As the plaid-wrapped athletes send the heavy balls of Aberdeen granite vigorously across the ice, or carefully sweep the crystal floor to a state of frictionless purity for the next effort, or measure the distance between a couple of stones with noisy and angerless vociferation, they are sure to have an admiring crowd around them. The curious Yankee, not "native and indued unto that element," pauses to watch the missiles, with a modest conviction that he could improve them; the little school-girl, sledding with her brother, glides slower past the fascinating sports of the good-natured, manly contestants. It is a crisp, eager, jolly game, imparting to the tame picture of the city lake a spicy flavor of wild loch-sports in North Britain. This animated scene, crowded with small faces and figures very difficult to engrave, is one of the most elaborate attempts of Mr. Brown, whose pencil, though loving rustic subjects, more generally seeks the softness and refinement of fair child-faces, and the delights of lovers, whose very whispers it essays to paint.

We must pass over without special notice the paintings by other American artists which we engrave on pages 46, 48, 50, 52, 54, 58, 60, 66, 68 and 70. The "Wheelwrights' Shop" by Mr. Billings; "Lake George" by Mr. Kensett; "Keene Valley" by Mr. Hart; "The Reproof" by Miss Sartain, daughter of Mr. Sartain, Superintendent of the "Art Gallery"—Miss Sartain's "Reproof" obtained a medal. The lovely statue of "Ruth" by Mr. Randolph Rogers, which is worthy of the highest award; the charming statuettes in plaster of "Hide" and "Seek" by Mr. Jno. Rogers; Messrs. Motts' reproductions in bronze of Canova's "Hebe," and "Psyche;" and most sparkling of all Mr. Forbes' "Beware!" Mr. Forbes' picture was in the Canadian department, where we found a number of landscapes and a most creditable display of water-color studies.

The British is the most modern of the great European schools of painting, and in its latest developments, has shown itself to be



MERCURY.
Italian Court.

inferior to none in variety of power. Remains have been found which prove that British artists had attained no small proficiency as early as the thirteenth century, and their works suffer nothing when compared with the Continental productions of the same period. When Holbein visited England, he found small demand for works of high art, and took to portrait painting. A period followed, during which it seemed as if art had sunk back again into its low condition, but the time was fast approaching when what is now regarded as the British School should come into existence, when the advent of Hogarth, Reynolds, West and Gainsborough should give to British Art an existence distinct and separate from other schools, and destined to grow with the growth of the nation.

The link which connects the modern British School with the past, is Sir James Thornhill, an artist whose admiration and respect for his calling was out of all

proportion to his scanty amount of ability. He had a son, Sergeant Painter to the Navy, but otherwise undistinguished. Sir James's daughter Jane became the wife of William Hogarth.

Within the ten years, between his thirty-eighth and forty-eighth years, Hogarth produced his different series of moral and satirical pictures; but, though a successful painter, he was not without the mortification of seeing that his contemporaries could only partially appreciate his great genius. His series of six scenes, known as "*Marriage a la Mode*" were sold by auction in 1750, when the painter was at the height of his power, in his forty-seventh year, but only one bidder appeared, and the whole series were knocked down to him at a hundred and ten guineas, while the frames alone had cost the painter twenty-four guineas.

William Hogarth was honest and frank, blunt yet benevolent. His portrait, painted by himself, is well known, or engravings from it, in which everything is English, down to his dog Trump, whose likeness is taken along with his master's. In his picture he sits in his plain English coat, vest, and cravat, and furred cap.

After Hogarth a new decade in art began with Sir Joshua Reynolds, whose portrait, by himself, is contributed to the Exhibition by the Royal Academy of London; in the same room—the north-west pavilion—are "*The Marriage of the Prince of Wales*," Stanfields "*On the Scheldt*," Wilkie's "*Digging for a Rat*," West's "*Death of General Wolfe*" and several other specimens of the best English art.

Sir Joshua Reynolds' portrait indicates him, so far as a very gentleman-like man could be, slightly dapper, under the middle height, and plump, in a well-fitting coat, spotless cravat and ruffles. The face round, almost chubby and ruddy, while keen, bright, and kindly. It is as a portrait painter that Sir Joshua takes high rank, though his imaginative pictures are considerable in number, and those of the "*Count Ugolino and his Sons*," the "*Hercules Strangling the Serpents*," not to say those pictures which have more or less of fancy in them, such as "*Mrs. Siddons as the Tragic Muse*," "*Garrick between Tragedy and Comedy*," have enjoyed a great reputation.



"The Great Exhibition, 1876."

VENICE DOING HOMAGE TO CATHARINE CORNARO.

By Mackart.

The Art Gallery.

The next great name in English Art which we meet in the same pavilion is Turner's, whose "Dolbadden Castle, North Wales," his diploma picture, is sent to the Exhibition by the Royal Academy of London. But the picture is so black that one cannot see much of Turner in it; much fear has frequently been expressed that Turner's colors are evanescent, and there can be no doubt that unless some "fixing" is done, the holders of Turners will some day find themselves holders of blackened canvasses.

When Turner was in his zenith, Wilkie arose, and although he has held less of the attention of the public than Turner received, yet his work—although principally *genre* subjects, whilst Turner dwelt most upon landscapes, marines, and architecture—will always hold, and possess many attractions for the art student and the picture collector. Contemporary with Wilkie, William Etty became as famous on figure subjects as was Wilkie with his selections appealing to popular taste. Etty is represented by a "Sleeping Nymph and Satyr," also an Academy diploma picture. Daniell, Constable, Gainsborough, Mulready, Landseer, Creswick and Maclise, all great men in art, of the past, are here represented; and the millions who have been in these rooms of Memorial Hall during the past six months, have enjoyed a greater boon than millions of the poor country-men and country-women of the artists; for those Academy pictures are closed to the public for the greater part of the year, and unless one has the taste and the money, few can run to London during the season to see the exhibition of pictures of the past and present. Of the present English Art there is a very liberal collection; and one has only to look over the catalogue to see from the names of Frith, Faed, Hunt, Millais, Ansdell, Goodall, Calderon, Tadema, Riviere, Poynter and Holl that England has done her best to please us, and we are thankful to her for sending valuable paintings belonging to the Nation, and those not the property of the Nation are the property of private collectors. We do not remember seeing one label "sold," on an English work of art; in striking contrast to other nation's exhibits where the ambition seemed to be that the owners or representa-

tives might have the *éclat* of truthfully attaching a "vendue" label upon a painting. Any one who gave the matter a thought felt a keen sense of littleness to pass along the corridors of the Art Galleries. Several rooms were devoted to salesrooms of New York print or chromo dealers, who exhibited pictures of which they



[The Great Exhibition, 1876.]

L'AFRICAINNE.

[The Art Gallery.]

By E. Caron.

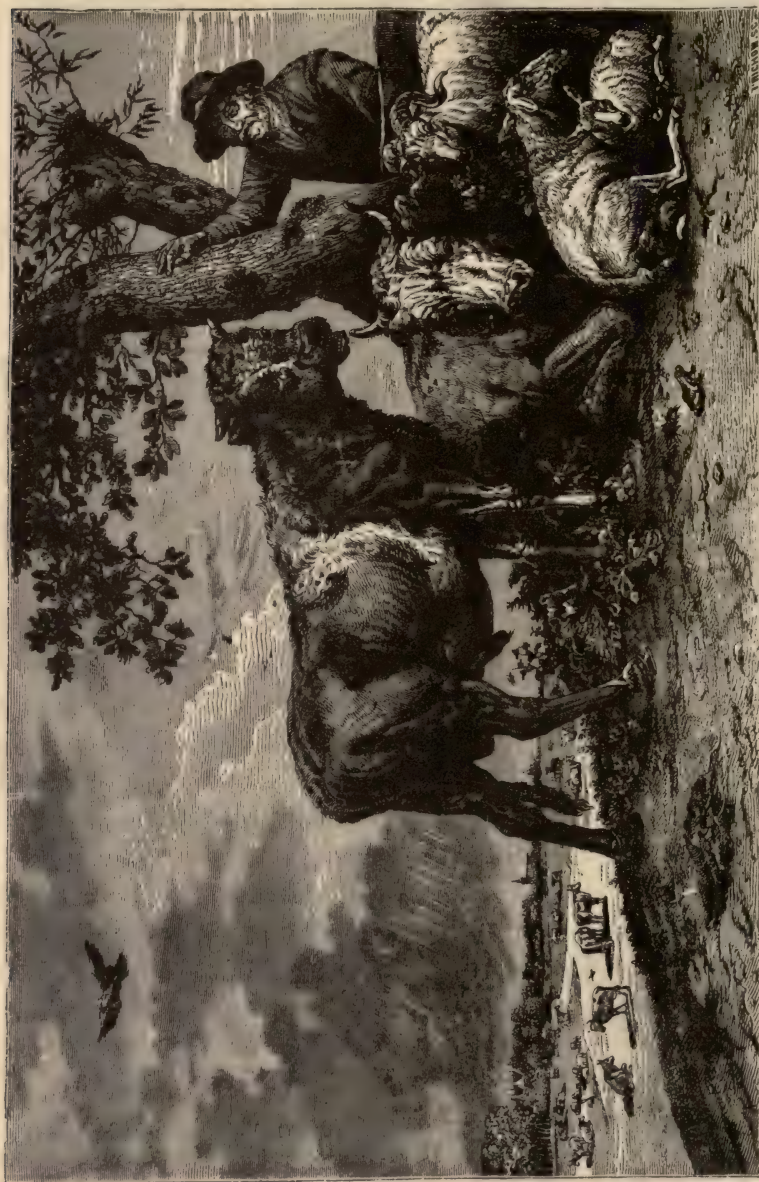
were not the artists, and had no more right in those rooms than had the owner of a panorama from the row of booths on the outside of the Exhibition grounds—provided the owner of the booth had paid the Commissioners a royalty upon his revenue. Next, it was painful to pass from a room in the Annex to confront

a row of cheap crockery-ware. Fine Art, forsooth!—with large advertisements, or posters, suitable for a barricade fence, relieving the Bowery-like displays. This was bad management and injustice to artists, the public, and to the exhibition itself. A contribution from a wax-work exhibition had a place in the Annex of the Art Gallery, but this seemed to be more than a slow-to-grumble American public would tolerate, and after a fortnight's exhibition of an object which no lady—or gentleman, for that matter—could look at, the Superintendent was obliged to order it off, and it found a place on one of the principal streets of Philadelphia, where people could gratify a questionable curiosity at so much *per capita*.

England, a “nation of shopkeepers” maintained its character in the Main Building, but its Art is held above the dust and worry of commerce. A private gentleman sent a “Venus,” by Gibson; Queen Victoria lent us one of the best pictures by our countryman, Benjamin West, and several others from her galleries; and the Duke of Manchester lent the portrait of one with whom every one of us has been familiar “from his youth upwards”—the portrait of Hannah More, she who called at the house of Macauley's parents, in London, one day. She was met by the future historian—then about four years of age—who came to the door to receive her, and tell her that his parents were out, but that if she would be good enough to come in he would bring her a glass of old spirits: a proposition which startled Mrs. More, who had never aspired beyond cowslip wine. When questioned as to what he knew about old spirits, he could only say that Robinson Crusoe often had some.

Chief among the English artists of the present day—and alone in his archæological art—stands L. Alma Tadema, who contributes several pictures to this exhibition; or rather they are contributed by their various owners, for we imagine that Mr. Tadema can have few pictures wanting purchasers. He is a native of Friesland, and for many years resided in Paris, receiving medals in that city and in Brussels for the uncommon merit of his works. Since the Franco-Prussian war he has lived in London; the artists

and art-lovers there have offered him that warm reception which



[The Art Gallery.]

THE YOUNG BULL.

After P. Potter.

‘The Great Exhibition, 1876.’

their nation has ever accorded to foreign talent naturalizing itself

among them, and which is at this moment enjoyed as well by Tadema's imitator, Tissot, as by the Americans, Boughton, Hennessey, Miss Lea, and Anthony Lumley, while its sincerity and cordiality remind us of the honorable treatment in England of Lely, Kneller, Vandyck, Rubens and Holbein. Mr. Tadema is one of the most eminent living archæological painters; his works restore the antique life of Greece, Rome and Egypt with that fulness and accuracy of detail which his teacher, Baron Leys, conferred on mediæval subjects. He exhibits now at every annual display of the Royal Academy, and has contributed no less than six of his most important works to the English section of the International Exhibition. They are "The Vintage Festival," "The Mummy," "Convalescence," in oil-color, which we engrave on page 86; and "The Picture," "The Three Friends," and "History of an Honest Wife," in water-color—the last subject in fact being three pictures framed together on account of the connected theme.

The original of "The Convalescent" is not large, and reminds us strangely of some mosaic just dug up from Pompeii—as highly finished as the celebrated "Pliny's Doves," and as dramatic as the "Choragus instructing his Actors." We are transported, by the magic art of this wizard painter, into the times of the later emperors, when *rococo* had completely usurped the simplicity and ponderousness of early Roman taste, when the arts of conquered Greece had rendered the Italians finical without rendering them elegant, and when even the false Egyptian and false Hellenic of Adrian had been forgotten, and the grandiose had sunk into the trivial throughout all the mansions of Rome. The Museums of Europe, the lavas of Herculaneum, and the fragmentary busts of the statue-galleries, have to be ransacked, for costumes, hints, habits and back-grounds, before such a group as "The Convalescent" can be constructed, so true to life in the first century. Amid the worst innovations of Pompeian taste—the bewigged toilets, the pillars painted part way up and merging into pilasters, the garments chequered with a confusion of colors, the household divinities made absurd with barber's block frivolity—he places his group of the invalid



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MOONLIGHT ON THE LAGOONS, VENICE.

By W. O. Orchardson.

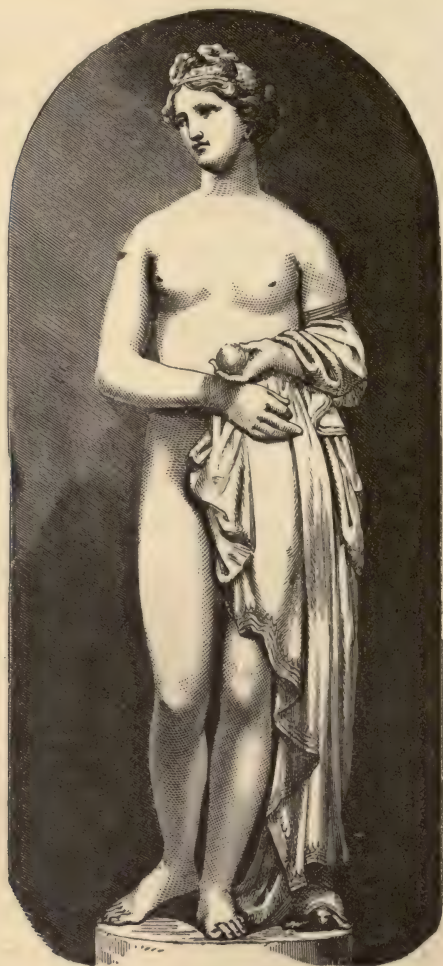
The Art Gallery.

dame and her attendants. He knows well that the imagination is more easily caught with the every-day litter and vulgar ugliness of a period of decline than with the frigid perfection of the more elegant epochs. The graceful figures of an Attic vase would touch us but slightly, and nothing would come of an effort to interest the mind with the Grecian couches and reclining nymphs of the classical period as the French restored them in the day of the Revolution.

Our artist's persons are direct, real, ungraceful, and convincing. The noble dame lounges on her carved seat. Her hair is bunched up into a hideous mop, which gives her infinite satisfaction. Her accomplished slave has dipped her hand into the round box of parchments, and has extracted some of the light literature of the day—not that story in Virgil which made an empress faint, but the love-poems of Ovid or the graceful fancies of Catullus. A younger slave-woman kneels in the foreground over a tempting luncheon. It is homely and stately at once. It is parlor-life in the days when they talked Latin without making it a school-exercise, and perhaps, in some cool corner around the pillar, Pliny is writing one of his pleasant letters.

Christian resignation, which soothes the bed of sickness, and finds an answer even for the yawning challenge of the grave, is most poetically illustrated by the British artist F. Holl, in his two subjects contributed to the Exhibition. One is entitled "The Lord gave, the Lord hath taken away; blessed be the name of the Lord;" the other, "The Village Funeral: 'I am the Resurrection and the Life.'" The former, lent by its owner, F. C. Pawle, Esq., forms the theme of our engraving on page 92, it seems to attain the very acme of religious pathos. We share in the first meal which unites an humble family after some awful bereavement. The watchers who have taken their turns at the sick couch are released now—their faithful task is over; the household whose regular ways have been overturned by the malady has come back to its wanton course again, and the pious nurses have no care to prevent them from meeting at the board as of old. Is there anything more dreadful

than that first meal after a funeral? The mockery of leisure and ease—the sorrowful, decorous regularity of the repast—the security from those hindrances and interruptions that so long have marred



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VENUS.
By John Gibson.

[The Art Gallery.

the order of the attendance—these improvements are here indeed, for what they are worth; but where is the tender hand that was wont to break the bread for the household?—where are the lips that used to breathe forth the humble grace before meat? It is

the very emptiness of a once cheerful form—the bitterness of meat eaten with tears. The frugal board is neat and pleasant—

“But oh for the touch of a vanished hand,
And the sound of a voice that is still!”

In Mr. Holl's picture we see this ghastly, unnatural decorum of the table spread with funeral bakemeats: the wan woman beside it, whose hollow eyes and tear-worn cheeks tell of faithful watching for many a weary night, is neat with the miserable neatness of the funeral evening; the young brother in the back-ground is brushed and combed more than his wont, and his attitude has an unnatural restraint; the old woman behind is tender and sympathetic, beyond the customary usage and practice of that kind of old women. Death has come among them all like a leveling wind, reducing everything to the regularity of desolation. Out of this weary scene of frustration and lassitude arise the words of the sincere-looking, earnest young curate: “The Lord gave, the Lord hath taken away;” he stands by the robbed fireside; he joins the family-circle whose most precious link is gone, and he confidently cries, “Blessed be the name of the Lord!” It is the very triumph of faith out of the jaws of death! Mr. Holl has uttered that sure word of promise which is the best reliance of our religion. In the assurance of the immortality which is to join the family at last in a more-enduring mansion, is the highest boon of Christianity. The expressions here are so earnest, pure, devout, and full of tenderness, that the painting is as elegant as a canto of *In Memoriam*. It is deservedly a great favorite, and forms a precious example of the intellectual and moral profundity which is the redeeming feature of English art.

The pathetic subject of which we give a representation on page 98, “La Rota,” is by Mr. Rudolph Lehmann, of London. The picture represents an incident only too common in Rome, where the scene is laid. A wretched mother has brought her babe in the evening to the foundling hospital, and is about to place the tiny creature in the “wheel,” or turning-box at the window, to become henceforth a waif and unclassified citizen. In a little while she



Vincenzo Viggari, Sc.

L'ABOLIZIONE.
Italian Gallery.

[The Art Gallery.]

will have departed, and the good nun within will search the receptacle for the little nestling, never more to know mother or kindred. The culpable and weak-hearted girl, of course, is not too hardened to part from her offspring without a pang; there is genuine grief in her last despairing kiss, and, perhaps, genuine pious feeling in the care with which the rosary has been brought along with the cradle. It is the resolute endurance of obloquy for the future advantage of the infant, of which the impulsive, impressionable Southern character is incapable; to find this heroism of the depths, we have to seek a sterner and more exalted race, among the duty-laden peoples of the North—*ex. gr.*, Hester Prynne, and "The Scarlet Letter." Mr. Lehmann has thrown his figure into a very graceful pose, without doing violence to that directness of action and uncalculating simplicity which the subject demands, and which these moments of soul-outpouring provide. The cradle deserves a note, too—cradle and basket at once, with hoop handle for convenient transport, such as the Italian poor make use of. How often has this cradle-pannier made its innocent journeys from door-step to hearth, and from floor to grass-plot, perhaps for generations, without consciousness that it should one night make its stealthy trip, along the narrowest, filthiest and loneliest alleys of Rome, to the "Rota" in the hospital of infamy!

Two of Mr. Orchardson's pictures, "Prince Henry, Poins and Falstaff," and "Moonlight on the Lagoons, Venice," the former lent by Mr. Moxon, and the latter by Mr. H. J. Turner, are in the principal gallery of the English Art Exhibit. Mr. Orchardson commenced his career as an artist by drawing on wood for the publishers, but during the past twelve years he has worked steadily at the brush, and has gained his reputation on such subjects as "Prince Henry, Poins and Falstaff." Indeed he is never more at home than in an interior; and what Terburg has done for the Dutch it is probable that Mr. Orchardson will do for the English of the last few centuries. He has wisely left Venice to the imagination in his picture of "Moonlight on the Lagoons," and except for the gondola, it might serve for a scene on the Mississippi or the Ohio.



"The Great Exhibition, 1876."

THE CONVALESCENT.
By Alma-Tadema.

[The Art Gallery.]

The gondola with its freight and attendants is on its way to the market in the city, to reach its place at or before day-break. Alter the character of the vessel, and we could fancy it wending its way across Lake Pontchartrain to reach the market in New Orleans by day-break. The picture is an excellent study of light and shade, but fulfils nothing in composition further than the canons of art demand.

Those who paid their visits to Europe by entering at the port of Glasgow, will remember with a sense of pleasure the sail up the Frith of Clyde, between the sloping lawns of Ayrshire on the east, and the grand and mountainous ridges of Argyleshire on the west. Mr. Wm. Daniell who lived the greater portion of his life on the edge of the sea, and made the circuit of England and Scotland from Cornwall by the west side, round the Hebrides and Orkney Islands, skirting the eastern coast, sketch-book in hand, and returning to the port whence he started, is represented here by the diploma picture he gave to the Royal Academy when elected a member of that most valuable institution. "View of the Coast of Scotland" is certainly the place we have indicated; and we fancy we see Culzean Castle, bright and romantic as it catches the morning sun of the picture.

In the room devoted to the South Kensington Museum are three studies for mosaics—that by Mr. Poynter of "Apelles" is one of the best, and his conception of the great Ephesian robs him of the atmosphere of romance, and makes him what he undoubtedly was—an ordinary human being with a wonderful genius of art. So high did Apelles reach in his profession that the Romans at one period spoke not of painting, but of the Apellean art. It is not so long since that we were surprised with the information that a famous collector of New York, now deceased, had paid sixty or seventy thousand dollars for a picture by the greatest French artist of the present day, but this is poor remuneration compared with the sums Apelles and contemporary painters received for their works. For painting Alexander wielding the thunderbolts of Jupiter, in the temple of Diana he received about

two hundred thousand dollars; and it was no unusual thing for artists of about that period to receive sums varying from one hundred thousand dollars to half a million dollars. So rich and generous was Apelles that he offered Protogenes, of Rhodes, five



"The Great Exhibition, 1876."

GANYMEDE.
Italian Gallery.

[The Art Gallery.]

hundred thousand dollars for his pictures on hand. Protogenes was not patronized by the Rhodians—Apelles recognized a true artist in Protogenes, and spread the report that he intended selling the Rhodian artist's pictures as his own, thus opening the eyes of

the public to the merit of their painter, and they accordingly secured his pictures at a still higher price. One thinks upon how plentiful money must have been in those three or four centuries before the era of Christ.

Of all the forms of the beautiful, perhaps none excite the admiration and sympathy of the public mind in a higher degree than the products of the sculptor's art. To the uneducated eye, the human form, modeled in clay or chiseled in pure white marble, seems fraught with grace and vigor, and an unconscious education of the feelings is going on as it gazes on the wondrous symmetry of a *Venus de Medicis*, or beholds the agonizing throes of a *Laocoon*. To the man of taste and refinement the process of thought and appreciation is different, though the ultimate effect is the same;—to both there is profit. While the ordinary mind is absorbed, spell-bound, entranced in a kind of admiring awe, the educated man admires, criticises, appreciates. Though the art-education of both men has been conducted on different principles, the result arrived at is precisely similar, and both are equally informed and humanized.

The art of sculpture, with the kindred arts of modeling, carving, and casting, are of very remote antiquity. The ancients availed themselves of almost every known substance capable of being cut or moulded into form; and we find the remains of figures, architectural ornaments, vases, lamps and pedestals, in marbles, woods, metals, ivory, bone, granite, porphyry, basalt, alabaster, stucco, wax, clay, and terra cotta or baked earth. There is no reason to doubt that the art of sculpture was known before the flood; and we have certain evidence that it was practised in India and America by civilized races of men, known now only traditionally, and of whom no other traces remain. Indeed, the discoveries of Mr. Layard in Nineveh, prove incontestably that the sculptor's art was practised, and arose to a remarkable degree of perfection, thousands of years ago. Universal as language, the art has risen from the rude forms of savage worship to the perfection in which we view it in our public buildings, our streets, and lately in the International Exhi-

bition. The productions in sculpture are either complete figures or groups, which may be viewed from all sides; or objects more or less raised, without being entirely detached from the background with which they are connected. This is called *relief*, the kinds and degrees of which are defined by modern writers and artists by the



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THE WHITE ROSE.

By P. Guarnerio.

[The Art Gallery.

words *alto*, or high relief, where the objects project so as to be nearly distinct; *basso*, or low relief, where the figure is slightly raised from the background; and *mezzo*, or half-relief, where not more than the face and half the figure is raised from the place on which it is sculptured. Examples of these were to be seen in the

Exhibition. Nothing can be more simple than the mechanical processes of sculpture. As soon as the artist has conceived his subject, and made his drawing upon paper, a model in clay, or some soft material, is executed in *little*. In the production of the model it is that the artist-mind is displayed; if *that* be true and natural, its transference to stone or bronze is a matter of comparatively minor importance. Upon a frame of wood or iron, the figure is built up to the size it is to assume in the chosen material, and moulded by the hands and certain simple instruments in wood and ivory. Arrived at this stage, the drawing, or original idea of the future state is reconsidered; and by the assistance of the human figure, minutely studied, is carried to completion. Statues are frequently modeled nude, and afterwards draped; and that accuracy of form, and gracefulness of outline may be obtained, draperies are commonly placed upon lay figures, the details of which are copied by the artist. When the clay model has sufficiently dried and shrunk, a mould is made of it by covering it with gypsum or plaster of Paris. When this is sufficiently hardened, the clay within is carefully removed, and there remains an exact mould of the model. This being carefully washed, and the interior brushed over with a composition of oil and soap, the mould is thoroughly filled in all its parts with a semi-liquid mixture of gypsum, which, in a few days, becomes sufficiently hard to allow the mould to be removed, and thus a complete cast of the model is procured. From this short description of the method almost universally pursued, it will be seen how the plaster casts in the International Exhibition have been produced.

The model is to be executed in marble. The process of transference is a matter of mechanical rather than inventive skill. By means of a long steel needle, attached to a pole or standard, and capable of being withdrawn or extended, the exact situation of numerous points and cavities in the figure to be imitated are ascertained; and the statue is rudely blocked out and pointed. A superior workman, called a carver, then takes the marble and copies the more minute portions of the work by means of chisels, files



"THE LORD GAVE, THE LORD HATH TAKEN AWAY; BLESSED BE THE NAME OF THE LORD."

By F. Holt

and rasps; and the statue being now in a sufficiently forward state, the final finishing touches are given by the sculptor himself. In the production of the model and harmony of effect, beauty of feature, variety of texture and surface, and consistency of detail in form and expression in the finished statue, the sculptor's skill is eminently displayed; and while the ancients relied almost on the chisel for their effects, the modern artist in marble approaches the surface of his statue with extreme caution, and employs safer means of giving a perfect finish to what may bring him both fame and fortune.

Italy, the mother of arts, contributed one hundred and twenty-nine oil paintings, few of which were distinctive, and but few of which were above mediocrity; we engrave on page 126, Michis' "Card Party in the Sacristy;" but as Italy has been most pre-eminent in its display of sculpture, we engrave a number of the most remarkable pieces. One of them "The Forced Prayer," on page 100, by Pietro Guarnerio, of Milan, bears off the votes of the greatest number of spectators. It is an epigram in sculpture, and it is epigrammatic sculpture carried to the limits of the permissible. This telling little figure has received a medal. It is easier to understand the subject from our spirited engraving than to construct it in the mind from a description. The handsome little rebel is standing in his shirt, sleepy and ready for bed, but denied the blessings of repose until the customary paternoster is gone through with. Conscious that there will be no rest for him until the ordeal is over, he begins to mumble the holy words with frankest hatred, throwing himself into the prescribed attitude of supplication like a trick-dog into his positions, with a skill derived from long practice rather than from feeling, while the implied devotion of the routine is belied by every line of his face, and from his piously lowered eye escapes the tear of temper and not of contrition. Of half-a-score varied works by Signor Guarnerio, this one probably has the most friends.

An instructive comparison of overcoming the technical difficulties of sculpture may be made by looking first at Mr. Bailly's

lightly-poised figure, and then at some of the sculptures which Italy has sent over with a lavish hand to the Centennial Exhibition. However these statues may disappoint the lovers of classicality and repose, there is no question that in overcoming



"The Great Exhibition, 1876."]

FARFALLA.
By Caroni

[The Art Gallery.

the stubbornness of material, they teach many a valuable lesson to our chisellers. We would indicate, as special examples of the triumph over this kind of difficulty, the hair in Caroni's "Africaine," which we engrave on page 76, and the effect in the same artist's "Farfalla," engraved on this page. These works, though completely dissevered from the Greek theory of sculpture, have a

rich, pictorial, and as it were, colored quality of their own which justifies the theory on which they are carved. If the success in representing texture were attained by an uncommon and worthless degree of mere *finish*, it would not be commendable; but examination will convince us that it is not the difficulty or the patience, but the live flash and expressiveness of the touch that gives the effect. The heavy crisped tresses of the "Africaine" are no more closely *finished* than the smoothest locks and bands of hair sculptured by Chantrey or Westmacott; but the sculptor, putting a brain into his chisel, has set it to thinking, and invented for his woolly convolutions a glancing, sketchy touch as expressive as the brushing of Reynolds on canvas. The Italian cleverness, as a mechanical and inventive development of resources, is well worth studying. Signor Caroni has chosen subjects well adapted to show off his rich and glittering style. In the "Africaine" we have the heroine of Meyerbeer's opera, the black Afric queen whose dusky soul was illumined with the light of tenderness at the visit of Vasco de Gama. For these primitive intelligences love is the apple of knowledge; when it is once bitten, the nature is changed, the Eden is spoiled, the contentment is lost, and the whole soul is thrown into the passion of desire, for bliss or for despair. In Signor Caroni's picturesque work we have the uncultured queen tortured by the pangs of a bootless passion, her supple body thrown broodingly beside the couch where her hero dreams of another, and watching with jealous eyes the lips that murmur of her rival. In his "Farfalla" we are amused with a lighter and more hopeful subject. It is all grace, spontaneity, sweetness, and pastoral charm. Its technical merits disappear under the gracious elegance of the conception. From "La Farfalla" to Selika, the "Africane," there is a gulf of transition, but the "Farfalla," lovely as she is, is eclipsed by the strange tropical intensity of the "Selika." Equal in the technical part of the carver's art, there is no comparison in the lofty scope of the subject.

We must pass without comment the various other excellent examples of Italian sculpture which are engraved in this division

of our work, and take a rapid glance at some of the other galleries.



"The Great Exhibition, 1876."

BOY AND BIRD.

By Peduzzi.

[The Art Gallery.]

Germany, for unknown reasons, did not do justice to herself. Many of her best artists were unrepresented. The number of

works in all was but one hundred and forty-five, and a large proportion was the property of the artists. Nevertheless there were several works of interest, such as Meyer von Bremen's "Gossips," and Count von Harrach's "Luther Arrested," which we engrave on page 130. The episode it depicts is described in the Life of Luther, and the Count has given us a living picture.

Austria contributed one hundred and twenty-three pictures, the most important of which, "Venice Paying Homage to Catherine Cornaro," by Hans Makart, which we engrave on page 74. It seems to be inspired by the happiest influence from Paul Veronese, and plays the same part as one of that master's crowded compositions in elevating the mind to a state of proud and noble happiness by the contemplation of an ideal festival-world bathed in heaven's own silver light. The subject is that fair Venitian who endowed Venice with the realm of Cyprus. Catherine Cornaro, a noblewoman of Venice about the middle of the fifteenth century, became the wife and widow of the Cyprian king, James de Lusignan. After ruling the island as queen for a quarter of a century, she at length conferred the island on her native country by abdication—certainly the queenliest gift that Venice ever received. The painter in dealing with the subject has pleased his fancy with the various sumptuous images evoked by this passage of history—the singular idea of a lonely lady governing the island consecrated to Venus from the earliest dawn of fable, and then by a feminine caprice of abnegation giving up her state and becoming once more a Venetian republican. He accordingly represents her seated on a wharf, whence steps descend into the sea, and whither the argosies of Venice direct their sails. Maidens kneel at her feet to offer her flowers and treasure; a statesman like a Venetian doge stands at the right hand of her throne; her courtiers are women; forms of beauty surround her on every side; musicians peal out her praises through their instruments of gold. It is the pomp and wealth of the Renaissance in Venice. The appearance of this picture definitely secured for Makart the esteem of his fellow artists, and made friends of some of his previous enemies, the



LA ROTA—THE FOUNDLING HOSPITAL, AT ROME.

By R. Lehmann.

[The Art Gallery]

critics. Among the latter, Bruno Meyer, who had spoken very severely about some of the artist's earlier work, declared that Paul Veronese's paintings must have looked like this when they were fresh from the easel.

Spain was represented by one hundred and forty-one oil paintings, Denmark by fifteen, Sweden by one hundred and fifty-eight, Norway by fifty-two, Brazil by ten, Mexico thirty-five—principally loaned by the National Academy—the Argentine Republic by thirty-four, Canada by one hundred and fifty-eight, France by two hundred and ninety-eight, England by one hundred and ninety-three and the United States by six hundred and eleven.

Among the seventy contributions of Russia were several that attracted attention. The subjects were mostly original, but the treatment had no distinctive national characteristic. It was, however, good, and worthy of comparison with the best in the Exhibition. The principal contributions were by Jooravleff, Semiradsky, Skirmunt and Lindholm,—the latter by a marine landscape, and the others by historical and *genre* subjects.

The Netherlands sent one hundred and sixty paintings, among which were many works of unquestionable excellence. Israels is the head of the school and is distinguished by delicacy of sentiment and simplicity of statement. He had two pictures which were well worthy of attention; but it is evident that this artist and nearly all the others in these galleries attach more importance to the teachings of the French school than to the traditions of the Dutch. Bisschop, the Mesdags, Kate, Van Elten and Altmann contributed acceptably to the display. Altmann sent several copies after well-known masters—one of them—Paul Potter's "Young Bull," was so life-like that a well-known collector at his first sight of this picture exclaimed, "What! Paul Potter."

Belgium sent one hundred and seventy-five pictures, and a small choice collection of statuary. In the room where the Belgian sculpture was, there were exhibited small terra cotta models belonging to the familiar picture sculpture school and representing scenes from domestic life. Their merit consisted in their broad

humor and true expression, to which may be added great care and ability shown in the modeling.



"The Great Exhibition, 1876."]

THE FORCED PRAYER.

[The Art Gallery.

By P. Guarnerio.

Sculpture is the grandest, most ancient, and most durable of the arts. The works which delight the critic of to-day, and are

believed to mark the golden age of statuary, date their origin many centuries before the Christian era. The full beauty of the human form has never been so accurately described as by the Greek sculptors. The mythology of the country gave to their efforts an elevation and purity of thought which in these days cannot be conveyed to similar subjects however skilfully manipulated. Hence, the tendency of sculpture has been to moderate the severity of the ancient school, and to create another in which clothes should not be wholly disregarded. The toga imposed itself on the thoughts and consciences of artists. Were it a booted warrior with a cocked hat that had to be depicted, he was found clad in the garb of a Roman senator. An absurdity so conspicuous could not long continue. A new school sprang up. Its aim was to call a spade a spade. If top-boots and a cocked hat were wanted, the disciples of that school were ready to supply them. Nay, if Achilles himself, in addition to his one natural defect had also had a mole on the top of his nose, they would have alighted upon it with enthusiasm. Excess of any kind naturally leads to reaction, and reaction took place. But the various theories still remain. The purists and the realists contend for their separate ideas, and the able men on either side prove how easy it is for both to be right.

France sent two hundred and ninety-eight paintings, and about fifty most beautifully executed pieces of statuary—in bronze or marble. France, like Germany, did not do justice to itself at this Exhibition. When we consider that nearly all the greatest names in French art were unrepresented, we can imagine what kind of exhibition of pictures France could make. Meissonier, Gérôme, Hamon, Fromentin, Troyon, Corot, Plassan, Toulmouche and Millet, all were conspicuous by their absence, while it was only the most indefatigable industry which discovered to us half of a picture by Rosa Bonheur, in the loan collection, and a whole picture by Cabanel in the same room,—the subject, “Francesca de Rimini.” The picture was loaned by Mrs. A. E. Kidd. Dr. George Reuling loaned the picture “Autumn,” the figure by Dubufe, the sheep by Rosa Bonheur.



By Tantardini.

THE READER.

An eminent art-critic has remarked that until late in the eighteenth century, the French school of painting was in all respects a branch of the Italian schools. This may be true, if it is intended to affirm that, until that date, the painters of France had no characteristic style of their own to distinguish them from the masters after whom they worked. But if by "School of Painting" we are to understand the actual painters of a given country, or a given period, then France had certainly many distinguished painters long before the eighteenth century. It is true that what Greek art had long been, and indeed still is, to the civilized world, the art of Italy became to the national schools of modern Europe—a standard of comparison and a source of inspiration, to which the several schools, after many intervals of de-

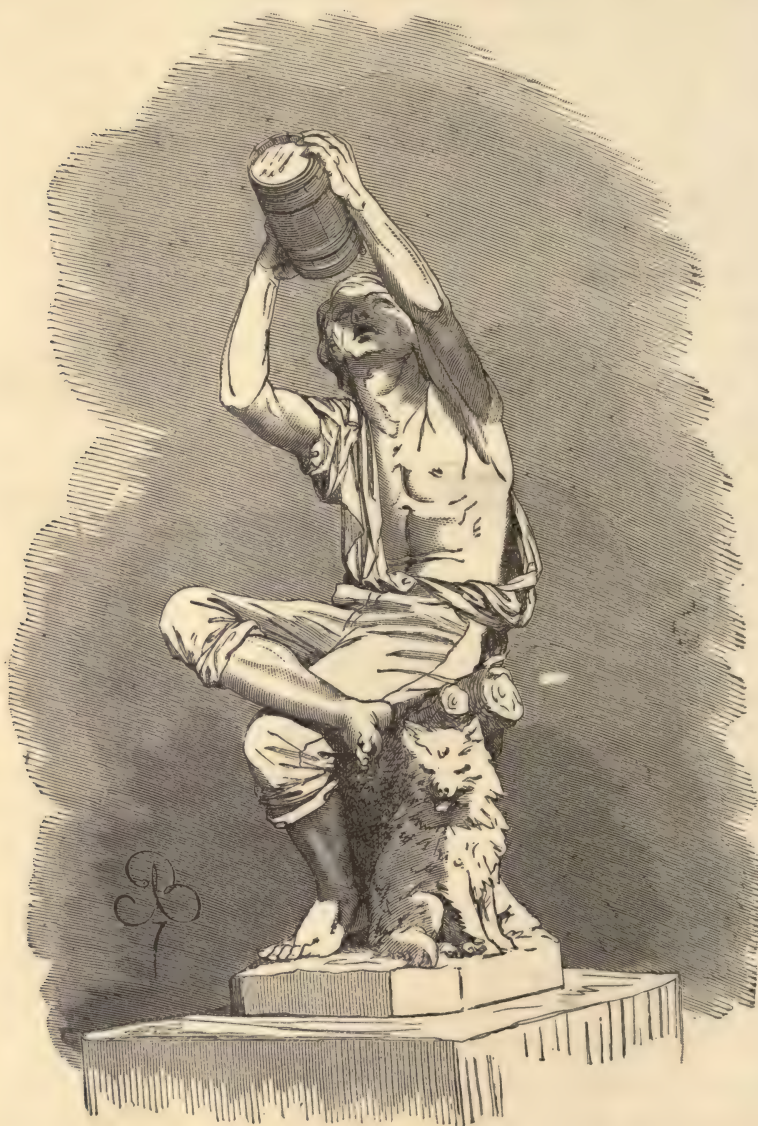
cadence, again and again resorted, for the purpose of readjusting their ideal and regaining the path of progress. Ever since the thirteenth age, the age of Cimabue and of Giotto, the schools of Italy have held the supremacy in pictorial art. Other national schools have, no doubt, produced great painters; but to none of them has the world of modern art turned, as it does to Italy, as the school of all schools. It must be admitted, however, that, at the present time, the sceptre of supremacy has fallen from her hands, as far as living painters are concerned. Her pre-eminence is a thing of the past. France, Belgium and England can produce better original work than any that Italy can boast. Her best artists have of late contented themselves with copying the great pictures of their ancient masters; and in copying they have lost the power of originating new and important works.

The commencement of art-history in France is traced by some voluminous writers to the era of glass-staining, which attained a high state of perfection in medieval France. The attempt has, no doubt, been made with a pardonable desire to assign as high an antiquity as possible to painting. Yet the rejoinder is obvious, that the two forms of art have no fundamental connection; each must stand on its own principles, which are widely different; and the dignity of French art-history is not really promoted by confusing things which have only a very remote relation one to the other.

Turn we to George Becker, of Paris, whose "Rizpah" is probably the most impressive picture in the Exhibition. One fancies this work to emerge from some gloomy studio, whose tenant is aged, tall, morose, and poetical. On the contrary, little George Becker is one of the least terrific and most likable of dwarfish youths, a mild butt for the raillery of his taller chums among the pupils of Gérôme.

Amid the paint-shops and costume-markets of the Latin Quarter is to be seen often a small fresh-faced figure, with a good aquiline profile overshadowed by an immensely tall and glossy hat; in the hand an artist's box of colors, which is of a size almost to drag upon the ground, and which conceals a large

proportion of the person of the walker, as he spreads his short



"The Great Exhibition, 1876."]

THE VINE GROWER.

By A. Bartholdi.

[The French Gallery.

compasses to their utmost distention in getting briskly over the

ground. It is Becker. "Come back with your color-box or in it," says the studio friend from whom he parts, alluding to the Spartan and his shield. He takes all jests with a quiet, good-natured smile, and goes home to paint tragedy. We recollect walking with him to the funeral of the painter Ingres, and the difficulty of keeping "down" with him, as he stepped with mincing tread among the mourners. It was snowing, and he asked a group who paused on the pavement near the church, "Shall we not seek a porte-cochère?"—while the attendants, opining that the flakes would have uncommon difficulty in finding *him* out, laughed at his anxiety even among the solemnities of the occasion. Such is the pleasant little lad, always mild, neat and conciliating, who goes into his studio, seizes his enormous brushes, and turns out for us the almost Michael-Angelesque composition of "Rizpah." Ah! in the presence of so impressive a work we scarcely think of the physical means by which it was created. We think of the idea alone, the terrible ordeal of constancy and maternity. Our engraving on page 106 gives a vivid conception of Mr. Becker's subject, though the imagination has to expand the cut to the size of nature, on which scale the original is painted, to get the full vigor of the tragedy.

The seven sons of Saul, whom David delivered to the Gibeonites to be hanged to avert the famine, are seen suspended from a lofty gibbet, in the evening of a stormy day. It is the commencement of their exposure, "the beginning of the harvest," and Rizpah has just initiated her gloomy watch against the eagles, which come sailing toward the corpses from afar. Over her head hang the fair young bodies of her sons, Armoni and Mephibosheth, and the rest. She is a strong Jewess heroine, a worthy mate for the giant Saul, and her posture while she fights the mighty bird with her club is statuesque and grand. As she throws up one massive arm as a fence between the aggressor and her dead, and looks into the eagle's eye with a glance in which grief is temporarily merged in horror and repulsion, we seem to hear the hoarse, desolate cry which escapes from her parched mouth to scare the famished



RIZPAH DEFENDING THE BODIES OF THE SEVEN SONS OF SAUL.

By George Becker.

creature from his prey. The attitudes of the dead youths are supine, with a languid and oriental grace even in death, and the curled Assyrian beards of the older ones contrast with the pitiful boyishness of the rest, while the whole row of princes, tender, elegant and helpless, forms the strongest contradiction to the direct, rigid, and as it were virile force of the woman. Another painter might have chosen the misery, the desolation of Rizpah's vigil for his theme. But this artist sees, in the whole long tragedy, the peculiar feature that it was *effective*. Rizpah *succeeded* in defending the relics of her family; the incessant watch, by night as well as by day, from the beginning of barley harvest until the rainy season, was grand because it was unrelaxed and vigilant. Mr. Becker, therefore, by sinking the mother's grief in her fierceness and energy, has developed the real sentimental force of the situation; any quite treatment would have lost it. He has delineated for us the first grand example in history of maternal devotion, the Mater Dolorosa of the Old Testament, in lines and colors that leave an unfading impression.

For the entirely graceful and feminine figure of "The Reader"—engraved on page 102—we are indebted to Professor Antonio Tantardini, of Milan. The same artist exhibits in the principal room of the Annex "The Bather," this figure proves the fact which has become proverbial among sculptors, that there are very few *poses* in nature for the artist to select from. Immense have been the number of "Bathers" contributed to art by sculptors and painters in want of a theme, the plain reason being that the situation of reading is one of the very few in which a modern female subject can be treated without any violation of modesty of character. The artist, impelled to make a study of nude flesh—after all, the worthiest exercise afforded by nature to the craft—can hardly find a situation in modern life which affords him the needed revelation, without the sacrifice of womanly character. The variations, too, which may be played on this delicate theme are infinite. Let the careless reader, who is disposed to pass by Tantardini's fine work with the hasty remark, "Only another bathing girl!" turn again to the



"The Great Exhibition, 1876."

PRINCE HENRY, POINS, AND FALSTAFF.
By W. Q. Orchardson.

[The Art Gallery.]

glowing and delicate episode of Musidora, in Thomson's "Seasons," as he reads for one more time this gentle pastoral, which the Italian sculptor seems to have been familiar with, he will comprehend the resources which art can find in the topic of modesty taken at a disadvantage.

Another sculptor of Milan, Signor Egidio Pozzi, contributes to the Exhibition a sitting male figure, supposed to represent Michael Angelo in his youth. We present an engraving of this work on page 131. The Milanese artist represents his immortal fellow-sculptor at that period of his boyhood when he studied all day long in the garden of Lorenzo dé Medici, "the Magnificent," in Florence, among the treasures of antique statuary which the growing taste of such collections had then amassed in that retreat. It is related that the first original work of the young genius was a face of an antique satyr, or faun—one of those grotesques which the architecture of the period demanded in abundance for the decoration of keystones and lintels. The greater the extravagance of expression, the richer the satisfaction of the architect, and the artists of the time exhausted their fancy in giving the look of leering, fantastic intelligence to these stone faces which peered over arches and portals, and conferred an air of conscious slyness and counsel-keeping on the various apertures of an edifice. Michael Angelo's first effort was as great a hit as the mature efforts of finished sculptors in this line, and the row of *mascarons*, or grotesque faces made by Jean Goujon for the Pont Neuf, in Paris, contained no example more expressive than this first specimen, which had been made by the elfish stripling in Florence. "However, your faun is wrong," said Lorenzo, laughing indulgently over the boy's shoulder. "He is old and has cracked many a hard nut with those grinning teeth; he ought to have lost some of them by this time." When the Magnifico passed next into the garden, young Michael had knocked out a tooth, and the patron, pleased with his own cleverness and the lad's, was unreserved in his praise of a work which now recorded a thought of his own within one of Michael Angelo's. The figure sent to us by Signor Pozzi is



"The Great Exhibition, 1876."

FELLAH WOMAN.

By Ch. Landelle.

[The Art Gallery.]

one of intellectual delicacy; it is hardly that of the fiery young goblin who drew his own face, with pointed ears as a satyr, before he was twenty-one, and who, in this same garden of Florence, so taunted Torregiano that the latter marked him for life with a broken nose. It is a representation of the ethereal, creative part of Michael Angelo's character. The lad before us seems likely to grow up into a sort of saraphic being, more like a Raphael than like the gusty and morose recluse who carved the Moses. Yet, it is undeniable that this lonely man had his side of ineffable tenderness, and there is artistic justification for the artist who chooses to represent that phase of his nature on which his contemporaries were continually harping, when they played upon his name and said that his works were executed by an "Angelo."

We are warned that space is scarce, and that matter must yield to illustrations. Much must therefore be left unsaid about many of the engravings which embellish these pages, and thousands of the works of art will forever remain uncopied by lens, pen or pencil, and more will remain unwritten. An effort in the last direction was made in the form of a hand-book to the Art Gallery—a simple catalogue with very brief descriptions, but a first glance at the pages in which we found Leutze's "Washington Crossing the Delaware" credited to Sully, satisfied us that we need go no further in our researches in that mine.

A work of considerable dignity and elegance, and one deserving respectful criticism apart from the mere stupefied admiration accorded to its gigantic size, is the colossal group of sculpture entitled "America," set up in the great Central Hall of the Memorial Building. Besides being an interesting reminder of a superb monument, it is noteworthy as probably the largest ceramic work ever made, except those Chinese towers confessedly put together out of small fragments. However many may be the segments in which the "America" group is cast, they must severally be enormously large, and in their grouping they produce an effect of perfect unity, so adroitly are their joints concealed. The memorial recently erected to Prince Albert, in Hyde Park, London, has



"The Great Exhibition, 1876."

HARVEST SCENE.

[The Art Gallery.

By E. Laporte.

occupied the leading sculptors of England for many years. The *podium* or central mass, covered by Mr. Armstead with friezes of the principal poets, artists and musicians, is approached by flights of steps on its four sides, the whole forming a vast platform, at whose corners are pedestals, quite remote from the central edifice, and respectively crowned with groups of sculpture. "Asia" is one of these groups, executed by J. H. Foley; the late P. Macdowell designed the group of "Europe;" the veteran John Bell, whose works, says Mr. S. C. Hall, "have long given him a leading position in his profession," is the inventor of the elaborate allegory dedicated to our own country. The quarters of the globe are backed by other groups of sculpture representing human achievement: as, "Agriculture," by W. C. Marshall; "Engineering," by J. Lawlor; "Commerce," by J. Thornycroft, and "Manufactures," by H. Weekes.

The collection of figures representing "America," which are worthy the attention needed to unravel their symbolism, may be thus described. America herself, the central and all-embracing type of the continent, rides the bison in the centre of the cortège. Her right hand holds the spear, her left the shield, decorated with the beaver, the eagle and other Indian signs; her tiara of eagle feathers sweeps backward from her forehead and trails over her shoulders; she is the aboriginal earth-goddess, depending upon kindlier forces to illumine her path and guide her steps. This office is assumed by the figure representing the United States; the serene virgin, self-confident and austere, wearing the lineaments of the Spirit of Liberty, belted with stars, and leading the earth goddess with a sceptre on whose tip shines that planet of empire which "westward takes its way," is the effigy of our own happy country. At her feet lies the Indian's quiver, with but one or two arrows left within it. Behind the figure of the Republic is that of Canada, a pure and fresh-faced damsel, wearing furs, and pressing the rose of England to her bosom. The figure seated on a rock, in front, is Mexico, represented by an Aztec in his radiating crown of feathers, with the flint axe, curiously carved, in his hand; a corresponding

sitting personage on the other side, is South America, a Spanish-faced cavalier in the broad-brimmed sombrero and gracefully folded poncho. These are the principal features of the lofty and



"The Great Exhibition, 1876."

VANITY FAIR.

[The Art Gallery.

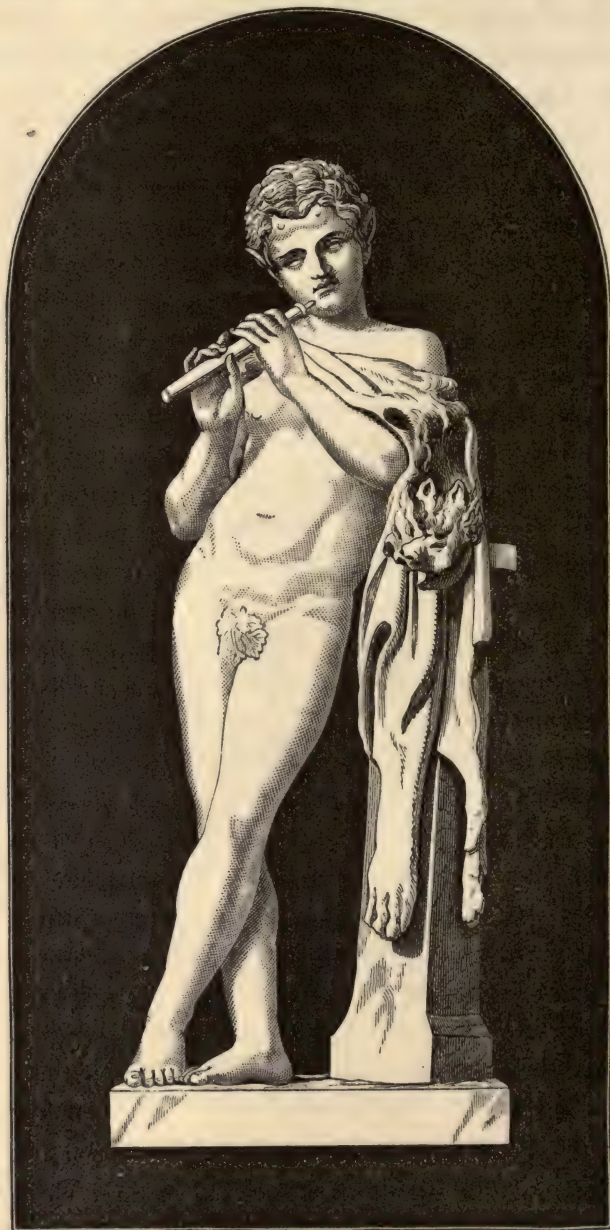
By F. Barnaghi.

elaborate group which casts its shadow over the floor of Memorial Hall. The artist has worked in such evident sympathy with and admiration for the Spirit of American institutions that he deserves

the most gracious recognition of this country; the original of this mighty group, beheld by all who pass under the marble arch and stroll towards the Serpentine, is a perpetual appeal for Constitutional Liberty, as we understand it; and the lesson taught by those sister statues, who, though crownless, subdue the rugged forces of the West, is not lost upon the thronging citizens who gaze upon them. The effect of the group as we see it, in the pleasant earth-color of Messrs. Doulton's terra cotta, is quite unique—something more exquisite and piquant than that of white marble, with which the eye becomes satiated after a long course of civic monuments.

English rustic life is well-depicted in Constable's painting of "The Lock," which is a piece of good fortune for us to keep for awhile in America. The importance of John Constable's influence and example cannot possibly be over-estimated in the progress of landscape art throughout England and the Continent. His effect on art is in fact considerably greater than that of Turner, because, while Turner's individuality cannot be imitated to any advantage, the discoveries of Constable are not altogether uncopyable. He was born at East Bergholt, in Suffolk, in 1776, and died at his home in Charlotte Street, London, on the first of April, 1837, with Southey's "Cowper," which he had been reading an hour before his death, lying at the bed-head on a table. Constable found landscape composition enthralled in the noble formality of Gainsborough and Wilson; by paying attention to nature, and not to any school, he invented a manner of his own, expressed certain phases as they had never been expressed before, and left behind him a body of works which were the code of a new faith in art. The mannered landscapes of his predecessor, Wilson, in England, have just the same relation to real scenery that the mannered descriptions of Pope and Shenstone have to actual effects; it is landscape gardening, not landscape; you are among groves that "frown," and "horrid" rocks, and "nodding" mountains, and all those other curiosities that are never found in nature by those who really love her, but are invariably lent to her by artists of the

drop-curtain sort; at the same time, on the Continent, the grand but



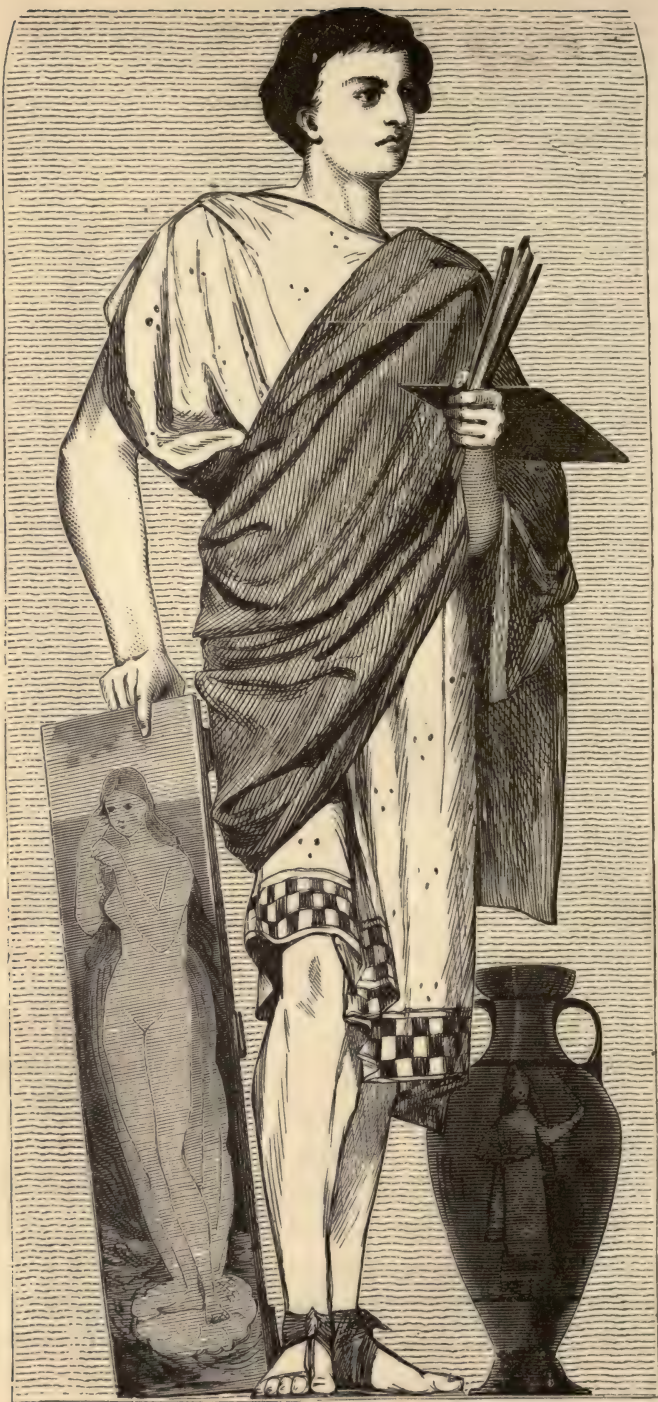
["The Great Exhibition, 1876."]

ORPHEUS.
By P. Guarnerio.

[The Art Gallery

baleful influence of Poussin had set all the world to formalizing

nature, and that of Claude had established his precedent of artful symmetry among those who could never reach his golden air. It was for Constable to charm away the whole world from the shrines of these divinities, and they are empty to this very day. His fresh and flashing style, so true to a single aspect of European climate, set every painter to looking, not upon antique bas-reliefs and Italian ruins, but right into the open, windy, showery, capricious sky, and among the dewy grasses underfoot. He made the lush and humid leaves twinkle with sense of growth and stirring life and mounting sap. He sent the scudding clouds flashing and darkening across the changeable sky; he swept this sky with rocking branches and tufted ripples of foliage. Although not altogether unappreciated during his lifetime, his fame has immensely increased since his death; along with "Old Crome" and Bonington, he enjoys a sort of posthumous elevation to the peerage; his slightest works are sought out like gold, and even the gallery of the Louvre, so very chary of credit to English art, has recently received with pride two or three of his pictures—one of them a very noble study of a sea-beach swept with shadows from a storm—and hung them in positions of honor. He is the true progenitor of such eminent landscapists as Troyon, Rousseau, Français, Dupré and even Daubigny—some of whom find their fortune in appropriating a mere corner of his mantle. "Among all landscape-painters, ancient or modern," says the celebrated C. R. Leslie, "no one carries me so entirely to nature; and I can truly say that since I have known his works I have never looked at a tree or the sky without being reminded of him." In his personal character Constable was winning, and conquered the most unpromising material to his allegiance; he would say to a London cabby, "Now, my good fellow, drive me a shilling fare towards so and so, and don't cheat yourself." Constable's picture at the Exposition, generously lent by the Royal Academy, is an important example. One of his flashing skies, summing up the whole quarrel between storm and sunshine, occupies the upper half; against this lean a couple of vigorous, riotous-looking trees, half-drunk with potations of superabundant English



"The Great Exhibition, 1876."

APELLES.
By Poynter.

[The Art Gallery.

moisture. Both these features are *modelled*: the sky shows as much light and shade as a study of sculpture, and the trees are moulded into their natural dome-like forms, with play of light and shade on the mass; in such a scene, an inferior painter is tempted either to keep the sky very thin, in order to get it well back from the invading trees, or else, if the sky has much variegation, to turn his trees into a mere dark screen, perfectly flat, so as easily to insure the desired contrast and difference of values. Constable boldly moulds his clouds, and vigorously lights the sunward edges of his trees, trusting to his close copywork of nature to get his firmament fifty miles away. A man in a boat is guiding the prow by means of a rope passing around a post through the brimming reservoir of the lock, which the care-taker is raising with a lever applied to the gate. Beyond stretches a level view of a flat country, of which a considerable stretch is commanded from the elevation of the race bank. In spirit and idea it is all English—homely, familiar, dew-bathed and tender. It reminds us, in temper, feeling and gratitude, of the lines in Matthew Arnold's "Thyrsis":

"Runs it not here, the track by Childsworth Farm,
Up past the wood, to where the elm-tree crowns
The hill behind whose ridge the sunset flames?
The signal-elm that looks on Isley Downs,
The vale, the three lone wears, the youthful Thames?"

In the crowded vegetation with which he fills the foreground of this picture, Constable is all himself. Without pedantic analysis of forms and genera, without that close attention to vegetable minutiae which invariably turns landscape art into botany, and destroys the higher truths of atmosphere, the painter gives with great success the vital principle of weed-growth—the confusion, the struggle for light and air, the soft brushing of leaf against leaf surcharged with moisture. This ardent study of a great inventor's, "The Lock," is twice noteworthy: first as it hangs, as a hit at nature taken on the fly, and second as a document, showing the invasion of realism into academic art early in this century. It is

in some of its qualities a *résumé* of the advice which West gave



"The Great Exhibition, 1876."

ANDROMACHE.

By Mott.

[The Art Gallery.

Constable in his youth and which it was not his own cue to act

upon. "Always remember, sir, that light and *shadow never stand still.*" Hamerton quoting this proverb, says, "It thus became one of Constable's main purposes to make people feel the motions of cloud-shadows and gleams of light stealing upon objects and brightening before we are quite aware of it."

We cannot leave the English Gallery without having another glance at the several pictures of Mr. Tadema's. The "Vintage" is of all these the most important. It represents the solemn dedication to Bacchus of the first fruits of the wine-press, selecting only the more elevated and dignified features of the ceremony—those deeply symbolic features, connected with the branches and fruits of the vine, the progress of the deity as a conqueror of the East, and his descent into hell, which touched the hearts of the early Christians, so that the Bacchic mystery was admitted as a type of the Christian, and the daughter of the first Christian emperor was buried in a casket enwreathed with Bacchic grapes and symbols, carved in enduring porphyry. In Mr. Tadema's exquisite picture we see the sacred procession winding into a Roman temple to offer homage to the planter of the vine. A beautiful priestess, crowned with grapes and holding a torch, advances toward the statue of the god at the left; turning her lovely face to the procession that follows her, she awaits the arrival of the offerings, while near the shrine some ardent priests with panther-skins tied around their throats, wave the cups of libation in ecstatic expectancy. Three flute-girls, with the double pipe bound to the mouth of each, a pair of dancers with tambourines, and a procession solemnly bearing wine-jars and grapes, advance along the platform, whose steps are seen covered with ascending worshippers and joyous Romans as far as the eye can reach through the colonnade of the temple. The perfect execution of a *pythos* or earthen wine-tub, enwreathed with the Bacchic ivy, and planted near the tripod in the centre of the scene, attracts attention. The grace and elegance of the chief priestess are positively enchanting. She forms as she stands a white statue of perfect loveliness, quite outdazzling the Bearded Indian Bacchus whose marble purity sheds a light around the



"The Great Exhibition, 1876."

CARRICK SHORE.
By Wm. Daniell, R. A.

The Art Gallery.

shrine. The most unexpected success of the artist, however, is that sense of religious calm and solemn gratitude which he has managed to diffuse over a ceremony dedicated to such a power as the spirit of the grape. Everything shows that the *symbol* as accepted by the early Church was most prominent in his mind, and that he wished to represent the parallelism between the True Vine and its imperfect type. The worshippers, elated by a really religious rapture, proceed to the offering with all the decorum of the Christian *agape* or love-feast, and the ornaments of the temple—pictures and votive images—hang upon the columns precisely like the “stations” and ex-voto offerings of a modern Roman church. The technical qualities of the painting are admirable; the action and character of the figures are completely Roman; the texture of the different marbles is felicitously given, and the silvery flood of light and air deluging the temple successful in the extreme.

We would like to dwell with greater fulness on the works of this artist, both because he reveals and teaches so much, and because a certain austerity and simplicity in his style keep him a little above the comprehension of the vulgar. The limits of this work, however, have been strained to admit even so imperfect a glimpse of his merits, and we must pass to other subjects. We cannot quite omit mention, however, of “The Mummy,” conspicuous by its strangeness and antique truth, in which the interior of an Alexandrian palace, filled with funereal preparations, is treated in oil with all the luminous limpidity of water-color; nor of “The Picture,” in which a Roman painter’s shop is realized for us; nor of “The History of an Honest Wife,” a quaint and moving story connected with the early Christianization of France. It is the peculiar distinction of Mr. Tadema to turn out in every picture a composition utterly unlike anything that has ever been painted before. The intense devotion of his mind to archæological research is rewarded by the unearthing of quantities of truths so old that they have the air of novelty; the texture and pattern of ancient garments, the ornaments of buildings, in mixed transitional periods, the habits of a vanished civilization, are made to flash on the eye

like a revelation. Not a shoe, not a finger-ring, but is of the epoch



"The Great Exhibition, 1876."]

THE ERRING WIFE.

Bronze by Gambos.

[The Art Gallery.

represented; the monstrous frizzled wigs of the latter empresses, the thick plaited ones of Egyptian kings, the tasteless cumber of

Pompeian or Roman colonial architecture, are set down remorselessly, with a love of the bizarre that sometimes verges upon caricature. With all this book-learning, his style is generally direct, limpid and transparent to a high degree; the simple sweetness of his coloring, and the soft tide of air that is felt to play easily through his interiors, are as perfect as in the work of the most ignorant painter of natural appearances, who ever confined his copy-work to his "impressions."

One of the rooms on the north side of Memorial Hall was constantly crowded by admirers of Wagner's "Chariot Race," now so well known to the people by means of engravings. When Romulus induced the Sabine women to come to Rome, it was to see the chariot-racing that those ladies trusted themselves in the city of the "Sanctuary," and this, according to the legend, was the first circus, or exhibition for horse-racing, ever held. Another legend informs us that L. Tarquinius, about 600 B. C., commemorated his success in arms by an exhibition of races and athletic sports in the Murcian Valley, in which temporary platforms were erected by individuals for personal, family or friends' use. These platforms surrounding the course gave place, before the death of Tarquinius, to a permanent building with regular tiers of seats in the manner of a theatre; to this the name of "Circus Maximus" was subsequently given, but it was more generally known as *the* Circus, because it surpassed in extent and splendor all other similar buildings. A few masses of rubble-work in a circular form are now shown the visitor in Rome, as all that remains of the ever-famous Circus Maximus; and although there were a considerable number of buildings of a like nature in Rome, they are all destroyed now, with the exception of a small one on the Via Appia, called the Circus of Caracalla, which is in a good state of preservation.

In the chariot race, each chariot was drawn by four horses; four, six and sometimes eight chariots started at one time; the charioteer, standing in the car, had the reins passed around his back: this enabled him to throw all his weight against the horses by leaning backward; but this rendered his situation dangerous in



"The Great Exhibition, 1876."

DURING THE SERMON.

[The French Gallery.

By Pietro Nicols.

case of an upset, occasionally resulting in serious accidents or death; to avoid this peril, if possible, each driver carried a knife at his waist for the purpose of cutting the reins.

The foremost driver in Wagner's picture has an air of mad hilarity and gratification in his face, and even in his whole bearing; and as he seems to wish to cast his eyes to see how much ahead he is of the driver on his left, who is imbued with carefulness and fixity of purpose, he little recks that one of his horses has reared in excitement, and may at any moment cause the loss of the race and imperil the lives of all concerned.

The enthusiasm of the Romans for the races exceeded all bounds. Lists of the horses with their names and colors, and those of the drivers, were circulated, and heavy bets made. The winning drivers were liberally rewarded with considerable sums of money, so that many of these charioteers, according to Juvenal, were very wealthy.

In Wagner's delineation of "The Chariot Race," he has embraced as many of the prominent features of an ancient circus as could artistically be brought within the canvas. To the left of us are the Emperor and his household; opposite to this imperial group, on the low wall, may be the president, or judge, and a number of spectators; near the ground of this low wall there is a grating: this undoubtedly is designed by the artist to indicate the proximity of the officiating priests' chambers. A portion of the pillar, on which were placed the conical balls, is behind this group, and a little further back is shown the cylindrical goal. The immense space between this and the Triumphal Gateway, and the great height of the building with its myriads of people, are not exaggerations, for according to very early writers this circus was several times enlarged until, at the time of Julius Cæsar, it was over eighteen hundred feet long (the length of the Main Building of the Centennial Exhibition,) six hundred feet wide, and capable of containing three hundred and eighty-five thousand spectators. A further idea of the size of the Circus Maximus is formed by comparing it with the capacity of the Coliseum at Rome,

which was capable of holding only about eighty-seven thousand people.

Times are indeed changed since Charles V picked up the brush that had accidentally dropped from Titian's hand; since Philip used to let himself in at all hours with a private key to the studio of Valasquez. Then kings and the noblest personages and the wealthy holders of Church property were the sole patrons of the artist. Since then, even thrones have become visible types of mutability; and the exchange of royal estates for limited civil lists often leaves the sovereign without the power to do what he would for art. The noblest personages of a later day are not always the wealthiest; the splendid endowments of medieval churches have been diverted to other less exclusive objects; and thus the artist has to look elsewhere for his encouragement, his means of livelihood, and his fame. The sovereign people are now the great patrons of art. National Galleries and Museums possess its choicest examples; private persons of easy fortune furnish their houses with pictures as a matter of course. Art-unions distribute works of art, and their reproductions, among a large public; the pencils of painters are engaged in the work of illustrating books and periodicals with greater pecuniary profit than a few pictures could secure. In humbler homes, engravings, copied from celebrated pictures, suggest at least the ideas of the master, when they do not reflect it with power of another sort, as they not unfrequently do. Zinc-engraving, wood-engraving, etching and photographic reproduction are busy popularizing works, which in another age could have been known only to a few who either lived in the neighborhood, or had undertaken a distant journey, perhaps in order to visit and admire them.

The question naturally arises, what effect is produced by so radical a change on the quality of art, and on the discriminating tastes of the people? It is a very important one, and not very easy to answer off-hand. Nothing, indeed, can be plainer than that some kinds of art have in consequence of the change, ceased to be inquired for, and therefore ceases to be supplied. Thus, for example, high



"The Great Exhibition, 1876."

ARREST OF LUTHER.
By Harrach.

[The Art Gallery.]

religious art has simply disappeared, as utterly as the Dodo or the lost pleiad. The remark applies to no one country in particular. It is universal. There is no use in concealing the fact, whatever may be its proximate cause. In Italy and Spain, high religious art is dead, quite as much as in France, which never possessed much of it, or in its best form; or as in England, which never possessed it at all.

As the principal patron of art is now the sovereign people, it follows, from their many-headed character, that portraiture is an engrossing branch of popular art. Here, at least as to quantity, the demand is abundantly supplied. As to quality, that is a different matter. A cursory glance around an Academy exhibition leaves the impression that it is all portrait. It is not of the likeness that any reasonable person can complain. If such a thing were possible, the likeness is often only too perfect. The coarse, perky, self-asserting, purse-proud air of the sitter is set forth with a truthfulness amounting to the keenest satire. There is no attempt to fine down imperfections, to idealize too realistic features. A "staring likeness" is probably all the sitter asked for in return for his or her money; and it is provided beyond cavil. Or, taking another common class of portraits, there is a face, and two corresponding hands, fairly painted, and connected together by a loose bag of clothes, without solidity or form or roundness; but just as they hung on the lay figure. It all has an air of haste, suggesting so many sittings for so many dollars. A keen observer of contemporary life remarks: "It is trade, not art; the aim is to produce money, not a painting. The terrible rule which infects all production, the rule of small profits and quick returns, is the death-blow of art. It is the rule that makes our painters tricky and vulgar, our literature flashy and untrustworthy, and our music popular in the worst sense. That is not the way great things are done. It is not the way our fathers did even little things." The judgment is severe; but, if strictly limited to the domain of art, we think it neither too severe nor yet inconsistent with a firm belief in the general progress of human affairs towards improvement

and the realization of the maxim: "The greatest happiness for



"The Great Exhibition, 1876."

MICHAEL ANGELO.

By Fozzi.

[The Art Gallery.

the greatest number."

We might extend our remarks into other departments of art, as, for example, into landscape and *genre*. It will suffice, however, to say that nothing appears more directly calculated to raise the character of modern painting in every department than the promotion of sound art-education among the masses of the people. To know a good picture from an indifferent one is not a natural gift, nor like one of the senses, the inheritance of all persons alike. It must be acquired and cultivated by studying good pictures. To this end museums of art works, lectures on art at our Academies, directly point. The same end, also, is powerfully served by the liberality of art-collectors, who permit the public to inspect their treasures of art. Education of the public eye and taste will soon react on the painters. Appreciation stimulates to higher efforts; intelligent and discriminating criticism exerts a wholesome and corrective influence on the eccentricities of genius. And while the discriminating critic exercises his functions of "discerning the glorious from the base," there is no one more ready than he to uncover and worship, the moment he recognizes the presence of one of the mighty masters of the pencil, who have received, how or whence no one can tell or imagine, the rare power of representing what they see, and much more than they see. Like poetry or music, in its highest form, art is "a power that comes and goes like a dream;" it is a hint of the eternal beauty that haunts us all through life, and insensibly draws us towards itself. Study and practice no doubt develop the manual dexterity, the penetrating observation necessary to the artist; but the original power of reproducing what is seen or imagined in the attractive forms of pure art is inborn and incommunicable. If a great poet is said to be a precious gift of nature to any nation, no less can be asserted of a great painter. Happy the nation that can appreciate his value when he comes!

PART II

THE MAIN BUILDING.



THE MAIN BUILDING.



WITHOUT HOSTILITY, RIVALRY is a definition at once concise and significant of the principle of all International Exhibitions. Here, by these same three words, is set forth the true motive for human action; and in the sentiment which they convey may be discerned the existence of a power capable of exercising the most beneficial influence upon human life.

That aspiring element in the mind of man which instinctively urges him—

“Ever to press on
To name and fame, and highest excellence,”—

implies the existence and the operation of rivalry as a condition of his being. Every man, in his own strife and struggle to attain superiority, constitutes himself the rival of his fellows; and all men are conscious that in every other man they may see a competitor in the common conflict, in which they all alike are engaged. But this universal rivalry possesses a twofold nature. As it may become essentially hostile, so also it may continue to be absolutely



MAIN BUILDING, FROM JUDGES' HALL.

without hostility. The aim and the purpose, indeed, remain ever the same. There always exists the very same strong impulse of spontaneous growth, prompting and pressing men on towards self-exaltation. In one case, however, the desired achievement is sought, perhaps altogether, certainly in no inconsiderable degree, through the oppression and degradation of all rivals; and thus a more eminent superiority elevates the successful competitor, by means of what he may have made his own at the cost and through the loss of others; while, in the other case, the aspirant to excellence seeks to stand higher through rising higher. He delights to see others rising with him, in their successes discerning only fresh motives and more urgent stimulants for renewed vigor in his own exertions; and, without relaxing for a single moment his efforts to surpass those around him, this man cordially encourages and even aids his rivals, should they chance to be able to attain to a position beside himself, or even to rise above himself.

The fine rivalry which not only permits, but constrains rivals to regard and to deal with one another as friends, rarely can fail to lead men on to excel (or, at any rate, to seek to excel) in those things that in themselves are excellent. The lofty spirit of such rivalry can be thoroughly congenial only with what is akin to its own nature—it necessarily rejects and refuses to have sympathy with objects and pursuits that are based though perhaps specious, that may possibly appear attractive or even dazzling, and yet in reality are unworthy and ignominious. And again, a truly peaceful rivalry such as this, which naturally inclines and as naturally attracts all within its influence to whatever is worthy and of intrinsic excellence, also teaches men in the very act of exalting themselves both to advance the general interests of mankind at large, and to promote the personal exaltation of particular individuals. The beneficial influences thus brought into operation, ever acting reciprocally, continually receive fresh strength as they prove to be regularly productive of greater and more important mutual advantages. The grand result is a system of combined action growing out of individual effort—a system based on the

broadest and most comprehensive good-will, in strict alliance with the noblest ambition which aims at a perpetual advance, to be accomplished by the concurrent onward movement of the entire community of mankind. A system such as this, in which aid



ENTRANCE TO MAIN BUILDING.

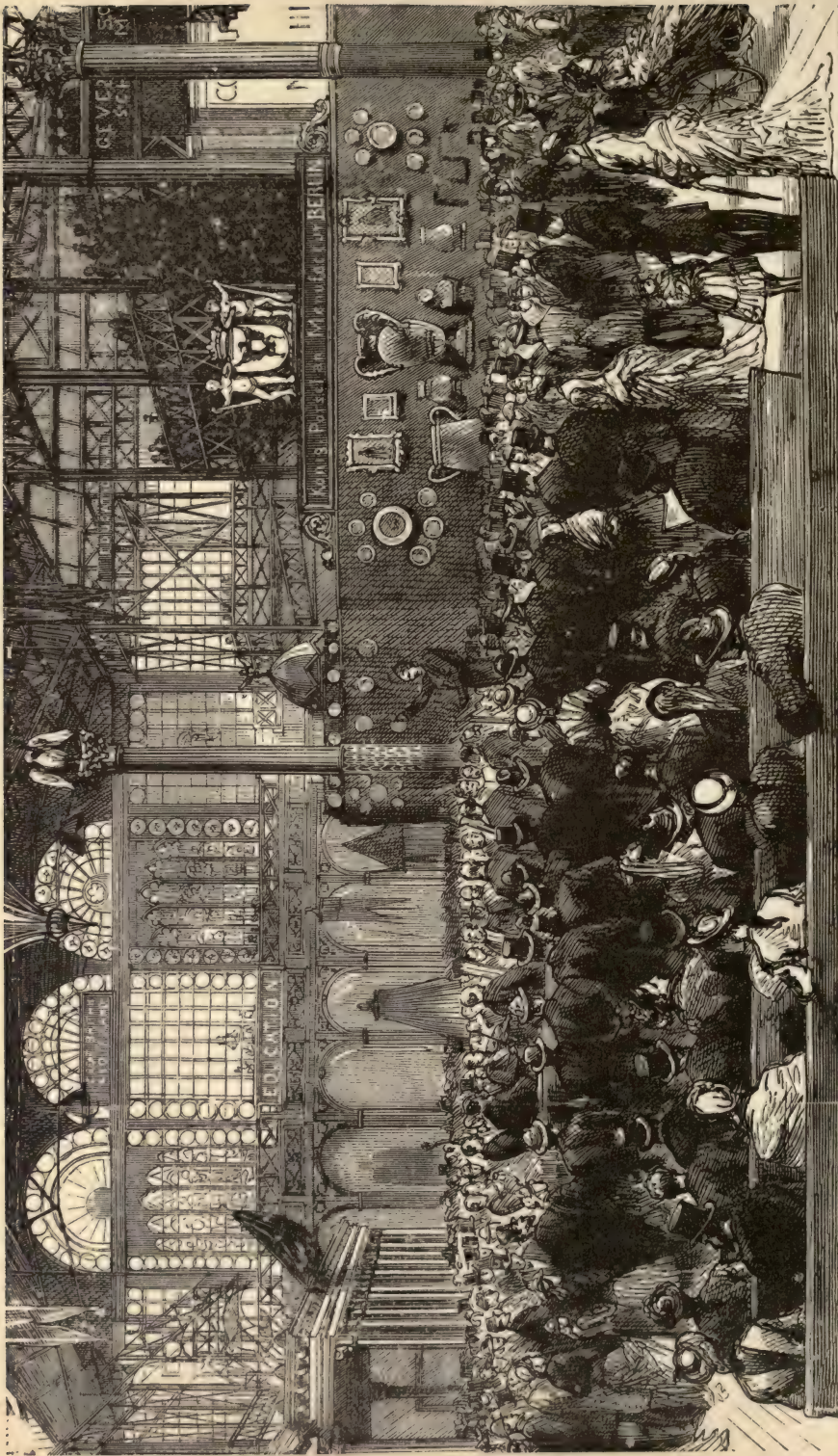
and encouragement are both sought from all and given to all, cherishes the emulous spirit in its happiest mood, and stimulates to the utmost its inherent energy. When all are advancing, each one that would not fall into the rear must rather redouble than relax his efforts, to ensure his keeping well up with the front;

and their efforts must be made again and again, always with more determined resolution, by those who, not content with the general front, aspire to a pre-eminence decidedly in advance of it.

By this friendly rivalry, acting under conditions through which it is empowered to accomplish its proper work, Peace achieves its happy triumphs. For, truly, Peace has triumphs signally its own; in nothing inferior to the very proudest that may be won by War.

Like thunder-storms, wars may be necessary convulsions; and certainly it is possible that, in their issue, the fierce and deadly contests of hostile rivalry may ultimately prove to have been beneficial. The rough interruption of all friendly enterprise for awhile may have paralyzed the arts of peace; and yet, when the storm shall have cleared away, in resuming their peaceful occupations men may find that they are working in a purer atmosphere, with a more open view also, and with fresh vigor and animation.

Rivalry, whether warlike or peaceful, requires that the rivals should meet and make trial of their relative strength. Accordingly, whatever practical influences for good a friendly competition may be able to exercise upon the communities and nations of mankind, in a very great degree must be dependent upon these two conditions—EXHIBITION and COMPARISON. Men must bring together the typical examples of what they are severally competent to accomplish, and they must show to one another their various works, with all their highest perfections, and all their unavoidable shortcomings; so that thus, through the broadest and the most comprehensive and searching COMPARISON between the visible exponents of their existing capacities placed side by side, the workers of all nations may learn both to form a correct estimate of their own deficiencies, and duly to appreciate each other's achievements. At the same time, and by the same means, every competitor in the noble rivalry of excellence may contribute to the inestimably precious lessons for the universal advancement, which are certain to be conveyed in the concentrated teaching of an universal assemblage and exposition of works of Art and Industry.



VIEW IN CENTRAL TRANSEPT, MAIN BUILDING.

The arrangement of countries in the Main Building is essentially a geographical one. The Building is in the form of a parallelogram, extending east and west 1876 feet in length, and north and south 464 feet in width. The larger portion of the structure is one story in height, and shows the main cornice upon the outside at 45 feet above the ground, the interior height being 70 feet. At the centre of the longer sides are projections 416 feet in length, and in the centre of the shorter sides or ends of the building are projections 216 feet in length. In these projections, in the centre of the four sides, are located the main entrances, which are provided with arcades upon the ground floor, and central facades extending to the height of 90 feet.

Entering by the great eastern portal the visitor begins with the United States, which extends north and south from the main avenue, on the south side, along to the central transept, and on the north side, to the Mexican Court; adjoining the Mexican Court are Brazil, the Netherlands, Belgium, Switzerland, and France, which latter brings the visitor to the central transept on the north side; crossing the transept we pass through the British Court to India, Canada, the Australian and other British colonies; these occupy, speaking roughly, two-thirds of the space on the north side from the central transept, and the remaining third is occupied with Norway, Sweden and Italy, which brings us to the western transept.

Crossing the main avenue, we enter the courts of Central America, and South American (except Brazil) exhibits. Turning eastward, we pass through China, Japan; the war department of Sweden; Denmark, Egypt, Spain, Turkey, to the south of which is Portugal; Russia, Austria, and Germany, when we find ourselves in the southern portion of the central transept, ready to again enter the United States, at the chemical or silver-ware exhibits, as our inclination or tastes may lead us. To the south of the Main Building is the Mineralogical annex, and north of the Main Building there is the carriage annex, a large and useful structure, with an excellent display of stoves on the northern

half of it. The central avenue of the Main Building is adorned with a large iron fountain in the east end, and by a small fountain of Doulton ware in the west end. On either side of the Doulton fountain, are a group of Minton's majolica ware, and a graceful cehotaph in terracotta, filled with specimens of Messrs. Doulton's faïence.

For the principal details of the Main Building we refer to the Commissioners' Reports, as follows:—

The EAST ENTRANCE forms the principal approach for carriages. The SOUTH ENTRANCE is the principal approach from



street cars, the ticket offices being located upon the line of ELM AVENUE. The MAIN PORTAL on the north side communicates directly with the ART GALLERY, and the MAIN PORTAL on the west side gives the main passage-way to MACHINERY HALL.

Upon the corners of the building there are four towers 75 feet in height, and between the towers and the central projections or entrances, there is a lower roof introduced showing a cornice at 24 feet above the ground. In order to obtain a central feature for the building as a whole, the roof over the central part, for

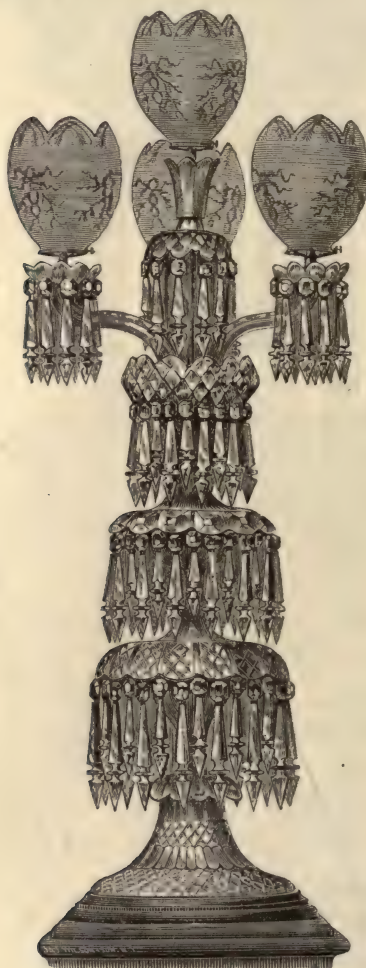


"The Great Exhibition, 1876."

CHANDELIER.
By Mitchell, Vance & Co.

[The Main Building.]

184 feet square, has been raised above the surrounding portion, and four towers, 48 feet square, rising to 120 feet in height, have been introduced at the corners of the elevated roof.



"The Great Exhibition, 1876."]

CRYSTAL STANDARD.

By Mitchell, Vance & Co.

[The Main Building.

The areas covered are as follows:—

Ground Floor,	872,320 square feet.	20.02 acres:
Upper Floors in projections,	37,344 " "	.85 "
" " in towers,	26,344 " "	.60 "
	<hr/> 936,008	<hr/> 21.47

The general arrangement of the ground plan shows a central avenue or nave 120 feet in width, and extending 1,832 feet in length. This is the longest avenue of that width ever introduced into an Exhibition Building. On either side of this nave there is an avenue 100 feet by 1,832 feet in length. Between the nave



"The Great Exhibition, 1876."

CLOCK.

[The Main Building.

By Mitchell, Vance & Co.

and side avenues are aisles 48 feet wide, and on the outer sides of the building smaller aisles 24 feet in width. In order to break the great length of the roof lines, three cross avenues or transepts have been introduced of the same widths and in the same relative positions to each other as the nave and avenues running lengthwise, viz.:

a central transept 120 feet in width by 416 feet in length, with one on either side of 100 feet by 416 feet, and aisles between of 48 feet.

The intersections of these avenues and transepts in the central portion of the building result in dividing the ground floor into nine open spaces free from supporting columns, and covering in the aggregate an area of 416 feet square. Four of these spaces are 100 feet square, four 100 feet by 120 feet, and the central space



"The Great Exhibition, 1876." **THE CENTURY CUP.**
By the Gorham Company.

[The Main Building.]

or pavilion 120 feet square. The intersections of the 48 feet aisles produce four interior courts 48 feet square, one at each corner of the central space.

The main promenades through the nave and central transept, are each 30 feet in width, and those through the centre of the side avenues and transepts 15 feet each. All other walks are 10 feet wide, and lead at either end to exit doors.

The following table gives the principal dimensions of the different parts of the building.



[The Main Building.

"The Great Exhibition, 1876."] ENLARGEMENT OF PORTION OF THE CENTURY CUP.
By the Corham Company.

DIMENSIONS:—Measurements taken from centre to centre of supporting columns.

Length of Building . . .	1876 feet	Width of Building . . .	464 feet
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CENTRAL AVENUE OR NAVE.

Length	1832 feet	Height of supporting columns	45 feet
Width	120 "	Height to ridge of roof	70 "

CENTRAL TRANSEPT.

Length	416 feet	Height to top of columns	45 feet
Width	120 "	Height to ridge of roof	70 "

SIDE AVENUES.

Length	1832 feet	Height to top of columns	45 feet
Width	100 "	Height to ridge of roof	65 "



ENLARGEMENT OF PORTION OF THE CENTURY CUP.

By the Gorham Company.

SIDE TRANSEPTS.

Length	416 feet	Height to top of columns	45 feet
Width	100 "	Height to ridge of roof	65 "

CENTRAL AISLES.

Length at east end	744 feet	Width	48 feet
Length at west end	672 "	Height to roof	30 "

SIDE AISLES.

Length at east end	744 feet	Width	24 feet
Length at west end	672 "	Height to roof	24 "

CENTRE SPACE OR PAVILION.

Ground Plan	120 ft. sq.	Height to ridge of roof	96 ft. sq.
Height to top of supporting col.	72 "		

TOWERS OVER COURTS.

Ground Plan	48 ft. sq.	Height to roof	120 ft. sq.
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CORNER TOWERS.

Ground Plan	24 ft. sq.	Height to roof	75 ft. sq.
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The foundations consist of piers of masonry.

The superstructure is composed of wrought iron columns which support wrought iron roof trusses. These columns are composed of rolled channel bars with plates riveted to the flanges.

Lengthwise of the building the columns are spaced at the uniform distance apart of 24 feet. In the entire structure there are 672 columns, the shortest being 23 feet and the longest 125 feet in length. Their aggregate weight is 2,200,000 pounds.

The roof trusses are similar in form to those in general use for depots and warehouses, and consist of straight rafters with struts and tie-bars. The aggregate weight of iron in the roof trusses



"The Great Exhibition, 1876."

SIDE OF VASE.
By the Gorham Company.

The Main Building.

and girders is 5,000,000 pounds. This building being a temporary construction the columns and trusses are so designed that they may be easily taken down and erected again at another site. The sides of the building for the height of seven feet from the ground are finished with brickwork in panels between the columns, above the seven feet, with glazed sash. Portions of the sash are movable for ventilation. The roof covering is of tin upon sheathing boards.

The ground flooring is of plank upon sills resting upon the ground, with no open space underneath. All the corners and angles of the building upon the exterior are accentuated by galvanized iron octagonal turrets, which extend the full height of the building from the ground level to above the roof. These turrets at the corners of the towers are surmounted with flag-staffs, at other places with the national eagle. The national standard with appropriate emblems is placed over the centre of each of the four main entrances. Over each of the side entrances is placed a trophy showing the national colors of the country occupying that part of the building. At the vestibules forming part of the four main entrances variegated brick and tile have been introduced. The building stands nearly due east and west and is lighted almost entirely by side light from the north and south sides. Louvre ventilators are introduced over the central nave and each of the avenues. Skylights are introduced over the central aisles. Small balconies, or galleries of observation, have been provided in the four central towers of the building at the heights of the different stories. These form attractive places from which excellent views of the whole interior may be obtained.

A complete system of water supply, with ample provision of fire-cocks, etc., is provided for protection against fire, and for sanitary purposes.

The form of the building is such that all exhibitors have an equally fair opportunity to exhibit their goods to advantage. There is comparatively little choice of location necessary, as the light is uniformly distributed and each of the spaces devoted to products is located upon one of the main thoroughfares.

The engravings show the Main Building, the Eastern Entrance, the Central Transept, and a bronze figure of an Indian, holding a candelabra, placed at the steps of the Music Pavilion in the centre of the main transept.

No more hopeful sign of the benefits of the Exhibition could be wished than that there has recently been incorporated the Pennsylvania Museum of Industrial Art; and that Cincinnati will soon



"The Great Exhibition, 1876."]

THE MILTON SHIELD.

By Elkin, ton & Co.

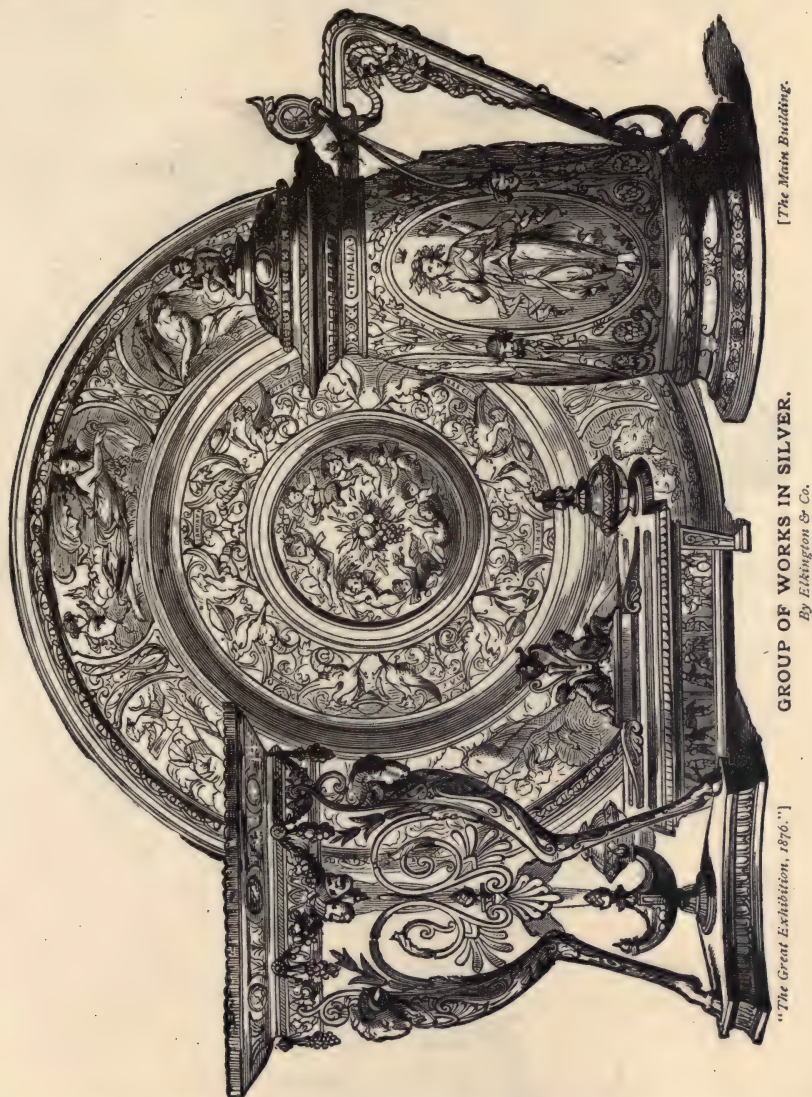
[The Main Building.

count a similar institution for the benefit of its citizens. This step in the cultivation of correct taste will not stop in these places, but will soon find place in all the principal cities in the Union. And then we hope to see many of our household monstrosities give place to objects equally useful—not any more expensive—and infinitely more pleasing to the eye.

It is scarcely necessary to say that the exhibit of Messrs. Mitchell, Vance & Co., of New York—one of whose chandeliers and a crystal standard we engrave on pages 143 and 144—excited very general admiration, being, indeed, second to none in that branch of industry, that any part of the world sent to the exhibition. They upheld the honor of the United States in that combination which is somewhat rare with us—a combination of pure art with perfection of manufacture. The chandelier was designed by the artist of the firm, Mr. Perring. The style represents the early Greek form of ornamentation; the main stem consists of a tapering pedestal ornamented with female figures in low relief, supporting a gracefully designed Greek vase, garlanded with laurel-wreaths. From the top of the vase the stem is richly ornamented and is crowned with a canopy formed by a succession of lions' heads in high-relief, holding gilt curb-rings in their jaws. Surrounding the stem are four fluted columns resting upon ornamental bases. These columns have richly-foliated capitals, and support a dome-like structure, upon which are perched a series of flying nondescript animals. Between the columns are four griffins, and from the pedestals which support them and the bases of the columns spring the several arms. The burners represent antique lamps, and are ornamented with shades in harmony with the general design. The chandelier is massive in appearance, but graceful withal, and is finished in the style known as *verd-antique*, and relieved at prominent points by judicious gilding. It has eight lights, and is one of the most elaborate designs of the kind ever executed in this country.

If the Gorham Manufacturing Company registered the number of visitors to its stall in the rotunda of the central transept, we

suspect the footing up would reach several millions. The first object which met the visitor's eyes was the trophy—the "Century Vase"—a work in solid silver, weighing 2000 ounces, designed by



Messrs. Wilkinson & Pairpoint. We engrave it on page 146. On the base are represented an Indian and a pioneer, the waning of barbarism, the first step in civilization. Groups of fruits, flowers



“The Great Exhibition, 1876.”

INDUSTRY.
By Elkington & Co.

[The Man Bussing.]

and cereals—of which we represent a large engraving in detail on pages 147 and 148—also surround the base. On the left is a group representing the Genius of War, with the torch in her right hand, while the left grasps the chain holding the “dogs of war” in check. A shell has shattered the tree, and a broken caisson wheel is



"The Great Exhibition, 1876."

THE NEPTUNE PLAQUE.

By Elkington & Co.

[The Main Building.

half buried in the débris on the battle-ground. The group on the right is the lion led by little children, musical instruments and flowers strewn on the ground, all denoting perfect peace and security. The medallion in front is the Angel of Fame, holding in one hand the palm-branch and laurel-wreath, and in the other

a wreath of immortelles and a portrait of Washington. The medallion on the opposite side is the Genius of Philosophy and Diplomacy, with one hand resting on the printing press, and with the other holding a portrait of Franklin. On either side of the plinth is a head of the bison, the king of the prairie. Having now passed the Revolution, and witnessed the restoration of peace, the Nation commences its growth; and hence from the plinth the vase rises.

On the front panel of the vase we see the Genius of the Arts, ready to inscribe on his tablet the names of those famous in Literature, Science, Music, Painting, Sculpture, and Architecture. In the reverse panel the Genius stands ready to record our advancement in Commerce, Mining and Manufactures. Crowning the vase we have the last and grandest scene in our hundred years of existence. Here is America holding aloft the olive branch of peace and the wreath of honor, summoning Europe, Asia and Africa to join with her in the friendly rivalry with which she enters on the second century of her existence.

The reader who has followed us through this description, and who will now turn to the vase, will see how splendidly this noble theme has been treated. Aside from the mere mechanical execution, which is perfect in its way, the story of the republic has been told by fitting emblems brought together in one harmonious whole, which in itself—more, perhaps, than any other feature of the design—typifies the cause of our great prosperity.

Leaving this retreat, but with the intention of returning, we cross the transept to Messrs. Elkington's exhibit. Since 1851 this firm has exhibited at every really international display, and carried off so many awards and medals that they may justly feel satisfied with opinions of jurors. No firm has ever succeeded in making as fine a display as the Messrs. Elkington—with the exception of copies from the antique their designs are all original, and the copyrights of designs are their exclusive property. Their exhibit comprehends nearly every class of workmanship in the refined metals and enamels. Entering the portals of this hallowed

place, with steps reverential to the many examples of true art, we feel grateful to this firm for making such a magnificent display; for all may look, and only the rich can possess these treasures, but it must be only the rich who are liberal of heart and intelligent to appreciate. Here is the Helicon Vase, repoussé in silver and steel, with its golden enrichments of damascened tracery, with



"The Great Exhibition, 1876."

PORCELAIN VASE.

By Daniells & Sons.

[The Main Building.

its twin recumbent nymphs and medallion reliefs of the muses; a work alike an honor to the artist, M. Morel Ladeuil, whose six years of patient toil have been well repaid, and a credit to the spirit and enterprise of the house of Elkington, for the cost of production does not fall far short of £6,000. Next to this is the fac-simile in electro of the Milton Shield, produced by the same

artist,—a work replete with poetic ideas, evolved with artistic force. The reader will observe our engraving of this wonderful subject on page 151.

The original of this work of art was manufactured for the International Exhibition of Paris, in 1867, and was purchased by the English Government for the Museum of Science and Art, South Kensington. It was, like the vase described above, the unaided work of Morel Ladeuil, who designed and wrought it by the repoussé process in silver and steel, with enrichments in damascened gold. In consequence of the original having already been exhibited, attention is now drawn to a fac-simile copy only, which is shown merely to illustrate how perfectly the most elaborate works of art in metal may be reproduced by the electrotype process, which preserves intact the finish given by the hand of the artist himself.

The subjects selected for illustration on this Shield were taken from Milton's "*Paradise Lost*," sixth book; and the able manner in which the poet's thoughts were rendered has been commented upon by several competent critics. Every face expresses the appropriate mental emotion or passion. There is awe and fear expressed in the face of Adam, and modesty in that of Eve, as they listen to the recital by Raphael of the conflict between the hosts of Heaven and Hell. The listeners are seated in Eden's bower, shaded with trees, with creeping plants, tender ferns, and spontaneously produced fruits, scattered at their feet in rich profusion. Confidence is indicated in the faces of the hosts of Heaven as they advance to the attack. There is Michael-Angelo-like force of drawing in the terrified faces and forms of the defeated rebels, as they are driven out of Heaven, and fall down to perdition in an endless variety of attitude, recalling the "*Last Judgment*." How fiercely St. Michael wields his flaming sword, as he stands on the prostrate body of the Dragon! Sin and Death are represented with their appropriate symbols at the bottom of the Shield, and soaring far above the regions of conflict, strife, defeat, sin, and death, seraphic and angelic figures, borne on wings, approach,

in attitudes adoring, the cherub-surrounded Emblem of all Light and Life, spiritual and material. The signs of the zodiac, with figures floating, symbolize the rolling year and flight of time, and delicately-worked leafage, in low relief, is introduced to fill up the space not occupied by the illustration of the poem.

The exhibitors display a large number of enamels, the designs



"The Great Exhibition, 1876."

PORCELAIN VASE.

By Daniells & Sons.

[The Main Building,

of which are due to the artistic director of Messrs. Elkington's Studios, Mr. A. Willms. To this talented artist, are also due the designs for nearly all the Decorative Dessert Services, Repoussé Irons and Silver Plaques, and other works of art exhibited by Elkington & Co. Regretfully leaving this court, which seems as if it were one of those belonging to the "Arabian Nights," we

enter that of another English firm, Messrs. Daniells & Sons of London. Although not manufacturers of the articles they exhibit, but simply the decorators, and representing the wares of several of the leading English firms in that branch of industry, they make a superb exhibit which is much visited, much admired, and no doubt has been profitable to the exhibitors. If no others exhibited in these industries, Messrs. Daniells' exhibit of Majolica and Faiënce would make a creditable exhibition in itself. We



"The Great Exhibition, 1876."

MAJOLICA STAND.
By Daniells & Sons.

[The Main Building.

engrave several of their choicest articles on this and pages 157 and 159. The engravings of the vases on pages 157 and 159 show their beauty of form and the exquisite designs which enrich them. The vases are porcelain of a deep chocolate color, of superior evenness and depth of tone. On this body after the first firing, the design has been painted by a process known as *pâte sur pâte*, or paste on paste,—a careful examination of our engravings will show what minute and delicate work is possible by this method. Each link in Cupid's chain, every leaf and flower, even the

finer folds of drapery are expressed with exactness. As we shall have to return to this exhibit, as well as Messrs. Elkington's, we shall defer our description of the *pâte sur pâte* process until then.

In the meantime we pass from this to the exhibit of Messrs. Brownfield & Sons of Staffordshire, who are manufacturers as well as decorators, and considering that their exhibit is the production of but one firm, they make an elegant display, and do much credit to themselves. From their exhibit we engrave on pages 162 and 163 four lovely dessert plates which look fitter to frame and thereby enrich the corners of one's drawing-room than to touch with a spoon. The subjects are all after well-known paintings and do not need description. The artist and engravers have faithfully reproduced the designs, and we are glad—as we cannot possess such a set of dessert plates—that we have them to look upon in black and white in these pages.

Before leaving the English exhibit of pottery and porcelain, we must glance at that of Messrs. Doulton & Co. of Lambeth, who manufacture many articles of household utility, in artistic designs, which do not cost any more than others with designs which are not artistic. In a secluded corner, at the foot of one of the spiral staircases leading to the towers, were statuary, a pulpit, and a font, in red terra cotta; the pulpit and font relieved by what is called Doulton ware. We engrave the font on page 165. The columns are covered with a delicate tracery of leaves, and the upper projection is separated by smaller columns into panels, each of which is occupied by a scriptural scene, chosen with reference to the purpose of the font. The engraving shows the complexity of the detail and the vigorous attitudes and gestures of the human actors in the little drama. The subjects of the panels shown in the engraving are "The Judgment of Solomon," "The Slaughter of the Innocents," and "The Adoration of the Wise Men." "The Dove of Peace," broods over the font, and each emblem is wreathed with the acanthus or lily. We also engrave on page 166 a group of mugs and pitchers of Doulton ware.

Near to Messrs. Doulton's exhibit, the Watcomb Terra Cotta

Co., of Devonshire, England, make a pretty exhibit of works in red terra cotta. From their exhibit we engrave on pages 167, 168 and 169 three subjects, "Nymph and Concha," "Sappho," and



"The Great Exhibition, 1876.")

DESSERT PLATES.
By Brownfield & Sons.

(The Main Building.

"Eve nursing Cain and Abel." The latter is a beautiful subject, delicately reproduced after the original by Le Bay. The original was exhibited at London in 1862, and excited such unqualified admiration that a very large amount of money was secured for

the artist by the sale of photographs of the subject, but his reward did not stop here, for he was granted a medal, many commissions for replicas in marble, and—fame. The Watcomb Terra



"The Great Exhibition, 1876"

DESSERT PLATES.

[The Main Building

By Brownfield & Sons.

Cotta Co. have done well to reproduce this charming subject, and if opportunity offers it will soon become popular in the United States. The "Sappho" and "Nymph and Concha," are beautiful examples of the high artistic qualities of a material too little

employed in this kind of work. Terra cotta—meaning burned or baked clay—has been used from the earliest ages as a material for jugs, jars and ornamental figures, and during the five centuries preceding the seventeenth it was largely used by the Italians in architectural decoration.

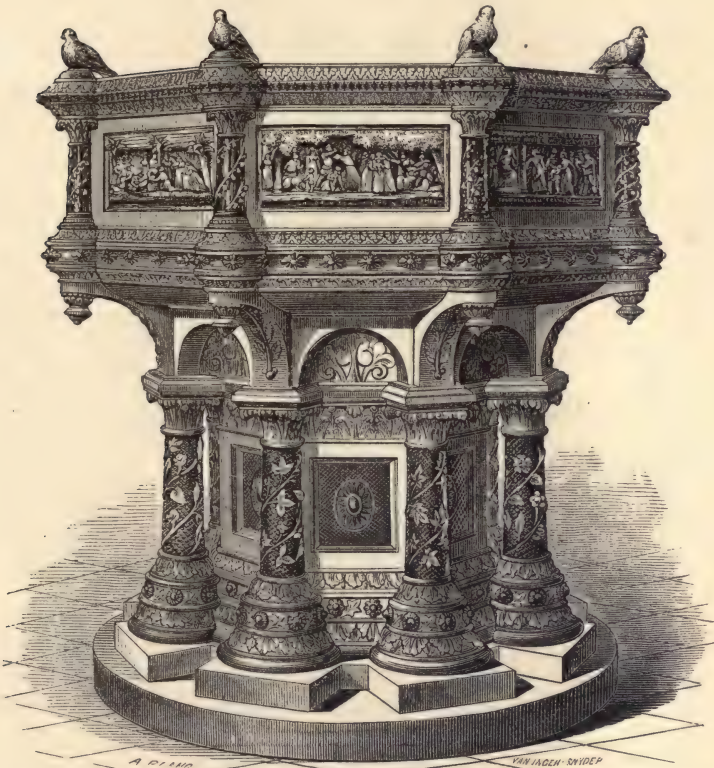
The baking of earth, especially of the stiffer pipe-clays, to form utensils, is one of the earliest achievements of men emerging from the savage state. At first, of course, there was no attempt at ornament. Then a rough checker-board pattern was scratched upon the sides of the pots and jars. The next stage was to lay a sort of scroll-work in black glaze over the earthen ground; and the pattern soon developed into conventional representations of plants and animals, of which the graceful foliated pattern around the neck of the larger vase is a beautiful instance. A still further refinement was the covering of the ground with the black glaze, leaving the pattern prominent in the natural color of the earth. The shape of Daniells' vases selected is simply charming, and gives a striking idea of the ductility of the material to the shaping of fire. The decoration is painting by hand, and the artistic feeling evinced in the patterns causes a regret that the finished product should be at the mercy of a careless servant. But this is an age when we have our treasures in earthen vessels, and we must assume that the buyer of such shapely ware will suffer no profane hands to be laid upon his terra cotta. What an education for the eye it would be if Mr. Eastlake's suggestion were everywhere adopted, and the tasteless china upon our wash-stands replaced by this beautiful ware, with its Greek figures and clear-cut conventional foliage!

Not the least notable of the English display is its furniture, interior decorations, carpets and tapestries. The firm of Jeffrey & Co., of London, exhibit several most artistic designs in paper-hangings. We select one, "*La Margarete*," and engrave the three sections which complete the design. The frieze—on page 170—shows "*The God of Love, and in his hand a Queen*."—*Alcestis*, the queen of wives—crowned with

the daisy and clothed in its colors as Chaucer describes in his Prologue:—

As she that is of allë flowres flour,
Fulfilled of all virtue and honour
And ever alike fair and fresh of hue.

PROLOGUE: *Legend of Good Women.*



"The Great Exhibition, 1876."]

FONT.
By Doulton & Co.

[The Main Building

Next in order are placed as not inappropriate attendants on the ideal wife, such domestic virtues as Diligence, Order, Providence and Hospitality, which will not be considered out of place in any house, and may fitly be represented as caryatides supporting the roof. Between the figures, the alternate plants suggest the text inscribed below them from Chaucer's "Flower and the Leaf." In the daisy pattern—half of which is on page 170, the other half

on page 171, above the Dado, thus showing the position of the paper when on the wall. The festoons of the daisy pattern can be increased, according to the height of the room. Below is introduced the burden of the song in praise of the flower from the same poem:—

“Si douce est la Margarete.”

In the Dado, the Purity and Innocence which the poet does not “clepe folye,” is further symbolized by the Lilies and the



"The Great Exhibition, 1876." GROUP OF DOULTON WARE
By Doulton & Co.

[The Main Building.

Doves. The design was furnished by Mr. Walter Crane, of London, an architect who has recently given his attention to interior decoration.

In ancient times the Arts comprised two great divisions,—the Liberal and the Servile. The latter were about equivalent to what we to-day call mechanical arts, and they received the name of *servile* because their practice was relegated to the slaves; whereas

the Liberal Arts, which included grammar, dialectics, rhetoric, music, arithmetic, geometry and astronomy, were practiced by freemen alone. At the present time, however, the world, while retaining



"The Great Exhibition, 1876."

EVE NURSING CAIN AND ABEL.

By the Watcomb Terra Cotta Co.

[The Main Building.]

the former term, makes a different division. We speak of the Fine Arts as distinguished from those which are simply useful or mechanical; and by Fine Arts we mean poetry, music, sculp-

ture, painting and architecture. But when we add to an article which, in itself, supplies a mere bodily want, such ornamentation as makes it lovely or pleasing to look upon, attractive to the eye or ministering to the wants of the mind, we at once place it in that great middle ground between Fine Art and mere mechanical execution, which is known as the field of Industrial Art.



"The Great Exhibition, 1876."

NYMPH AND CONCHA.
By the Watcomb Terra Cotta Co.

[The Main Building.]

Thus, only excluding the production of raw material, Industrial Art might be made to include every branch of labor. But, as a matter of fact, the application of art to industry, while affecting all branches of manufacture, has found its chief expression in a number of special directions; as in the decoration of textile fabrics, whether by stamping a pattern on, or weaving it in to, the material; in the making of tapestry, lace and embroidery;

in ornamental printing and bookbinding; in furniture, upholstery, paper-hangings and *papier-mâché*; in the manufacture of iron, steel and copper, and especially in braziers; in working the precious metals and their imitations, as in jewelry; and in the production of glass and pottery.

For many years France has asserted and maintained her supremacy in the manufacture of bronzes—a supremacy doubtless due to the



"The Great Exhibition, 1876."

SAPPHO.

[The Main Building.]

By the Watcomb Terra Cotta

superiority of her Schools of Art, where her workmen are specially prepared and educated in correct principles of design. In this special industry—that of the bronzists—a thoroughly organized and widespread system of education prevails, and the result to the nation is shown in what has been almost a monopoly of a particular industry of immense pecuniary value. Recently, however, other nations have entered the field in competition with the French

bronzists. Germany has developed some excellent talent; and



more recently England, by devoting herself just as France has so long done—gradually to training the young workmen up from

the Art School to designing and modeling for metal-work—has



[The Main Building.]

"LA MARGARETE" PAPER.
By Jeffrey & Co.

"The Great Exhibition, 1896."]

gained for herself an excellent reputation. Such work as is exhibited by Messrs. Cox & Son, of London, a house whose productions are

known all over the world, could not be produced by any but workmen whose education has been not only in the workshop and foundry, but also in the studio.

We ask the reader to give this work of art-manufacture the



"The Great Exhibition, 1876."

SNAKE-CHARMER.

By Cox & Sons.

[The Main Building.

degree of attention which it merits. The material is bronze—first cast in a mould, and afterwards finished with the chisel. The subject is an Indian Snake-charmer, a class of men frequently met with in Asia and India and throughout the tropics. Observe the ease and gracefulness of the pose. One arm is raised, the hand holding

a wand round which the snake is twined. The man's head is bent backward as he watches the reptile, while in the other hand he holds the small pipe, just removed from his mouth, by which he has created the charm. The left foot placed firmly upon the ground supports the weight of his body, the other, resting lightly upon the lid of the closed basket, suggests the idea that the snake upon the wand is but one of several—the others being confined in the basket. The figure is in a sitting posture, and yet there is no relaxation to the muscles. We can see that the man is on the *qui-vive*, though the moment chosen is one when he naturally would be perfectly motionless. Herein lies one of the greatest merits of the work in a purely artistic sense. To attempt to convey a sense of motion in a statue or carving is not good art. Movement belongs entirely to the domain of the painter. The Laöcoon, one of the grandest works of ancient art preserved to us, while at first view it may seem to contradict our assertion, will be found on a careful inspection to be but a proof of what we say; and we do not remember a single instance of what is generally acknowledged to represent the best efforts of antique sculpture which can be cited against us.

The household furniture in the Exhibition is especially worthy of note. The English division abounds with beautiful apartments, fitted up with all the *meublerie* of a parlor, dining-room or bedroom. The influence of the South Kensington Museum and of the Schools of Industrial Art, which derive their stimulus from that Museum, is nowhere so apparent.

Of woman's work, the Exhibition contains many examples—some of it, such as the carving in wood, of a kind heretofore monopolized by men, and others, such as the needle-work, of a character truly feminine. In this latter class, decidedly the most interesting display in the Main Building is the contribution sent from London by the Royal School of Art Needle-Work.

This School, recently founded by the Princess of Schleswig-Holstein and other noble ladies, under the patronage of the Queen, has for its object the revival of that famous embroidery

and other work of the needle for which the women of England were so famous three centuries ago. It will be remembered that at that time England had the reputation of making the finest ecclesiastical vestments in the world. But with the decay of



"The Great Exhibition, 1876."

SCREEN.

Royal School of Art Needle-Work.

[The Main Building.

the Church came a corresponding decadence in the demand for embroidery, and consequently the art fell into disuse. Chiefly owing to the encouragement now given to it by the Royal School is this beautiful branch of woman's work being revived. The School

employ the very first artists and designers of England to furnish them with designs, and in the display sent to this country are patterns by such well-known men as Morris and Crane and Pollen.

We select for illustration a Fire Screen, embroidered in a very delicate manner, which is a favorite one among the pupils of the School. This consists in copying the leaves and flowers in color and veining with careful exactness, and at the same time conventionalizing



"The Great Exhibition, 1876."]

CHAIR.

Royal School of Art Needle-Work.

[Main Building.

their general arrangement to allow of the repetition of the design as part of one pattern.

The second piece is a Chair, also embroidered—the design evidently the work of an artist, probably Crane himself. Work of this character requires long practice and skill with the needle, as well as instruction by competent individuals. But the general result is so satisfactory, and the work itself is so thoroughly feminine, that we sincerely trust something of the same kind will be attempted in this

country. We have a fancy that our lack of art schools and other institutions where women can learn to employ themselves usefully and profitably at work which is in itself interesting and beautiful, is one of the causes which drives them to so unsex themselves as to seek to engage in men's affairs. Give our American women the same art facilities as their European sisters, and they will flock to the studios and let the ballot-box alone.

The origin of glass staining is a disputed honor, and in such conflicts we are for the present neutral. Unlike painting, sculpture, or the many branches (such as mosaic) cognate to perfect architecture, glass painting was an art exclusively ecclesiastical and Christian in its origin and development. It was the application of the principles and ideas of mosaic to the new wants of architecture for the adornment of the church; and the early masters of this art on glass atoned for their want of variety and pictorial effect by the beauty and brilliancy of their ornaments and color. With them a window was an integral portion of the structure, both in outline and quantity and quality of decoration; and many of the specimens executed at that early period were esteemed then, and are yet admired, as high examples of the original principles on which the art was based—depending for perfection, as it did, on the harmonious arrangement of colored light.

Marcilla, the Frenchman, an old prior, who afterwards made Arezzo his home, so constructed his designs that the joinings of lead and iron, by which the glass was bound together, formed parts of his design; and this he did with so much skill that his works could not have been complete without them. These joinings became the deepest shadow of a fold, or the sharp relief of some other portion of the drapery or subject, so that what in so many inferior hands became a defect was, in his, converted into a beauty and advantage. Besides, he only used two shadow colors, but these with such discrimination and effect, that his glass staining, while realizing its own proper qualities of breadth and depth, had some of the fascinations of pictures. In France and the Low Countries especially, those who followed this branch became historical painters upon glass, instead of

on panel or on canvas—a total perversion of the original principle, the one being to produce light through well balanced color, arranged in thoughtful form; the other being an attempt to imitate oil painting or fresco in a style of relief, which must make the transmutation of light a subordinate object, and where prevalence and multiplicity of shadow must interfere with the breadth and brilliancy of the general effect.

Our next illustration is an admirably-designed Stained Glass Window, manufactured by Cox & Sons, of London, the well-known ecclesiastical decorators. The sub-



STAINED GLASS WINDOW.

By Cox & Sons, London.

ject is that beautiful incident in the life of Christ when he gathered the multitude about him on the mountain and spake to them those words of mercy and tenderness and love—so different from the lessons of the elders—which have come down to us through the ages, bearing their sweet message of consolation and hope to many a weary heart; their divine wisdom becoming but the more apparent as we recognize what those few simple precepts, uttered eighteen hundred years ago, have done toward revolutionizing the nations of the earth, and bringing civilization out of barbarism. It is very

right and proper that Christian people should be constantly reminded of this sublime occasion; and no means are so effective and real than to aid the imagination by means of pictorial representations. Long before the art of painting and staining glass with figures was invented, frescoing and panel-painting were in common use. Yet it was a glorious thought which first conceived the idea of making the church-windows, through which the light of day diffused itself



"The Great Exhibition, 1876."

GROUP OF CHURCH PLATE.

By Cox & Sons, London.

[The Main Building.]

throughout the sanctuary, a medium by which the splendor and glory of that other and first Light should be typified in the mind of the worshippers with colors such as no canvas can produce. Of all the adornments which man, in his desire to make the house of God beautiful, has brought into the church, the stained glass window is, to our thinking, the most appropriate and beautiful. It may be simply contrasted masses of harmonious color, or it may be as elaborate a painting as the subject of illustration; and in this respect it is

one of the noblest forms in which art may express religion. We



"The Great Exhibition, 1876."

CORONA.

By Hart, Son & Peard, London.

[The Main Building.

also engrave, on page 178, a group of ecclesiastical vessels exhibited

by the same firm; and on page 179 a Corona, in gilt bronze, by Messrs, Hart, Son & Peard, of London.

When we remember that the first International Exhibition was held in a palace of glass, which was decorated by its grand fountain of glass, and had its one hundred British exhibitors of glass in all



"The Great Exhibition, 1876."



[Main Building.]

GLASSWARE.

By James Green & Nephew, London.

its various applications, it is difficult to account for the apathy shown on the present occasion, only a few exhibitors of all kinds having appeared.

Mr. J. Green, of London, and Messrs. Millar, of Edinburgh, however, did credit to Great Britain, and their magnificent display will long

be remembered by those who had the pleasure of seeing it. From the superb chandelier, which was so conspicuous an object in the British Department, down to the plainest wine-glass in the varied



"The Great Exhibition, 1876."]

GLASSWARE.

By J. Miller & Co., Edinburgh.

[Main Building.

exhibition on the stands below, everything told of purity of material, great care in manufacture and good taste in design.

Another old and esteemed firm, which has never been behindhand upon such occasions, is Messrs. Miller & Co., of Edinburgh. The

quality of the specimens they exhibited was unsurpassed, and they were as remarkable for good taste in design and decoration as for the fine quality of the material. The specimens we engrave on pages 180 and 181 are fair examples of their best work.

There were several table services of new designs in the finest polished cutting executed in close resemblance to engraved work by means of extremely small wheels with fine edges. The designs consist of interlaced bands and simple bands and shields of the most minute cutting, with festoons of polished beads and circlets of pearls. The beads and pearls are polished as well as engraved by the wheels.

Of the regularly engraved designs there were numerous beautiful examples, and they were quite free from that too common error of glass cutters and engravers, namely, over-crowding. It is too frequently the case that the engraver forgets that there is a beauty in the material itself quite apart from the work he bestows upon it, and in his anxiety to show as much as possible of his skill he covers the surface and confuses the work.

Variety is essential in all things, and in nothing more than in the subject-matter of a long discourse. The carpets displayed in this International Exhibition are, with some striking exceptions, very different in design from those exhibited in 1867 or 1873. Then, the leading specimens were not coverings for floors, but paneled decorations in worsted for walls; still the majority of what were then considered the great works in carpet were all of the wall-decoration character, from those for the palace, designed by Louis Gruner, to those "got up" by the Kidderminster manufacturers. Now, with one or two exceptions, all this is changed so far as American makers are concerned, and the change has been mainly in the right direction. That such an alteration should have produced some crudities and confusion of ideas among those engaged was only to be expected, and therefore faults may be overlooked in rapid progress in a legitimate path; but false principles deserve no such tender treatment, because if these are left to luxuriate without comment or rebuke, the results may be as radically mischievous as those which have so happily been discarded. In the majority

of cases it has already been seen that a carpet is something



"The Great Exhibition, 1876."

CARPET.

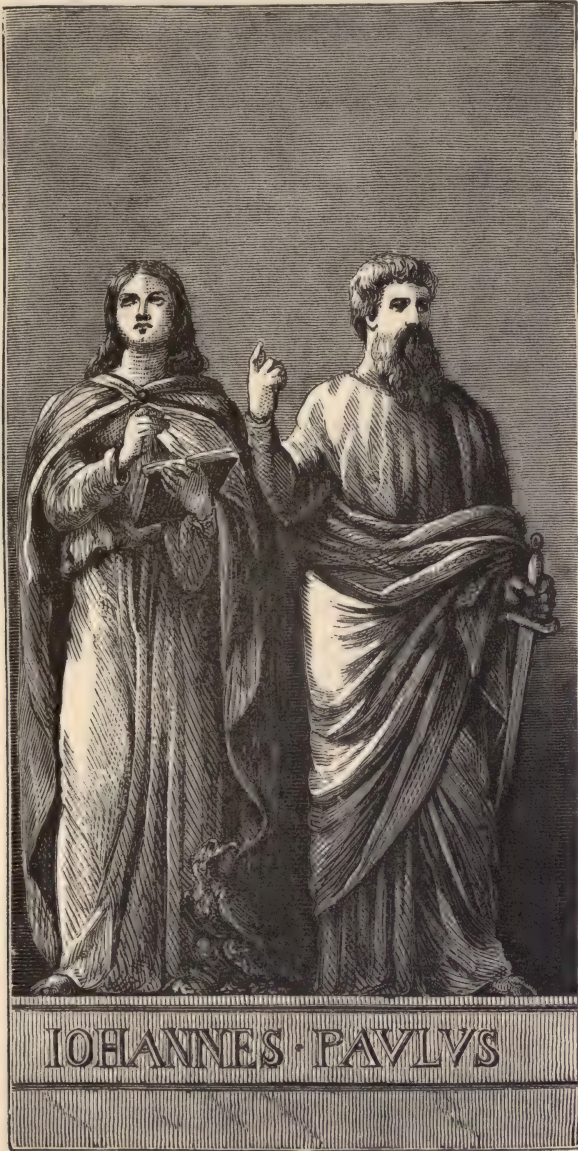
[The Main Building.

By J. Templeton & Co.

entirely different from a wall decoration: it has now to be dis-

covered that it is something equally far removed from a tiled floor on the one hand, and a French shawl on the other, and that while it ought to have a distinct quality of general forms, the quality of its details ought to be equally specific. That, for example, bands to imitate bedstead bottoms, although placed in diamond shapes, are not agreeable things to walk on, any more than ribbons, on which one could not move without the feeling of danger from entanglement; neither is it more pleasant to trample musical instruments under foot, however beautifully executed in relief through weaving. In all such cases, the better the work, from a nationalistic point of view, the worse the carpet for the legitimate purposes of that article, because all such objects would naturally be avoided in places of traffic or promenade. To an American housewife, if she think at all on such subjects apart from the anxious thought of out-rivalling Mrs. Grundy, the primary thoughts about a carpet are that it shall first be comfortable, which includes "tidy," and that it shall then be ornamental,—not in the sense of attracting attention by its gaudiness, but ornamental in unison with all other objects upon it and around it: that it shall not only form a comfortable and solid basis for the feet, but that it shall "set off" the furniture, the decorations on the walls, and if necessary, as in a drawing-room, the inmates of the room also. None would seriously differ in words from this description of the legitimate uses of carpets, however taste might differ respecting the style that would best secure these ends. The wall-decoration style failed, and has been very generally discarded, although in some instances a reflex of that style is still adopted in the form of what may be called single paneled carpets—a style so certain to follow that from which it sprung, that nothing but the names which have by popular rumor adopted it, makes it of more than momentary interest. In urging objections to this reflection of an exploded style for carpets, a clear distinction must be made between things that differ; and because these carpets have borders, it does not necessarily follow that all borderings are wrong. On the contrary, for many purposes the principle of a border judiciously applied

is both advantageous and ornamental. We engrave two specimens



TAPESTRY.

After Thorwaldsen's John and Paul.

of worsted work—one a carpet, on page 183, exhibited by Messrs. Templeton of Glasgow; the other on this page is portion of a

screen carpet exhibited by Messrs. Tapling of London. The whole design represents Christ and the Apostles after Thorwaldsen's designs; the carpet, or screen, is about forty feet long by about fifteen feet in height.

From the exhibit of Mr. Goggin of Dublin we engrave on pages 186 and 187, three brooches in bog oak. For many years the manufacture of bog oak into articles of personal adornment has formed an important branch of Irish industry; the exhibit of



"The Great Exhibition, 1876."]

BROOCHES OF BOG OAK.

By C. Goggin, Dublin.

[The Main Building.

Mr. Goggin fairly represents the adaptability of the material for other purposes, such as small boxes, fans, snuff-boxes, &c. It has never found much favor in this country, principally, we suppose, because it has not been shown to our public in its most attractive forms. Mr. Goggin's exhibit we trust will create a demand for an article always chaste in itself and capable of being put into artistic forms.

As there is no branch of art which has received greater impetus from international exhibitions than that of Ceramics, it was only

fair to suppose that the International Exhibition of 1876 would present a remarkable display to those who can remember the dawnings of the revival in the London Universal Exhibition of 1851. Nor have such expectations been disappointed; at no era in the world's history has such a show of man's power to mould the plastic clay into forms of beauty ever been seen. Moreover, although the higher branches of the art have only as yet been developed in a few well-known centres, it is abundantly apparent in the present exhibition that a feeling for its æsthetical principles has permeated human society to such an extent that even the humblest potters in the most distant countries show that they are alive to the necessity of supplementing utility with good taste.



"The Great Exhibition, 1876."

BROOCH OF BOG OAK.

[The Main Building.

By C. Goggin, Dublin.

To those who, like the writer, have studied the history and effects of great international exhibitions from their dawn in 1851 until the present time, it is in the highest degree interesting and instructive to observe what powerful and manifold interests they have excited in the civilized world; but in no branch of human industry is this so apparent as in the manufacture of Ceramic and vitreous wares. In our own country especially, the pottery of the people, which is the truest indication of the good or bad taste of a nation, is now far from what we should wish it to be, whilst in the higher walks of the art we stand lower than any other civilized nation.

The value of the potter's art to a nation can hardly be over-estimated, for in supplying some of the commonest wants of the

household the eyes of those using them can unconsciously be instructed in the beauties of form and color, and even in pictorial art. And so certainly is this accomplished that we venture to assert without fear of contradiction that the pottery of to-day will be unsaleable ere half a decade has passed over us. No well educated political economist of the present day will deny that a nation's wealth is increased by the diffusion of good taste amongst the people. It may be thought, by some, from too cursorily glancing at our ordinary crockery shops that there is no great improvement, and that very bad taste is abundantly shown, and this



DECORATED DESSERT PLATES.

By Daniells & Sons.

is true in the abstract; but all Europe, and perhaps even the more ancient civilizations of India, China, and Japan, are in a transition state in matters of art. A new Renaissance has commenced, and in spite of adverse critics, it will go on. It may be that the result will not equal its predecessor, but if the history of the older Renaissance be fairly studied it will be seen that its commencement was certainly not more promising, and we venture to say not so much so as the present. One thing is quite certain, the artistic results of the Renaissance period, however much they influenced the tastes of the wealthy, had but little influence on the masses, whereas the movement now going on permeates every

class of society. It is true it does not at once annihilate the errors of the past. It does not all at once substitute good taste for bad, but like all really good reforms it gently replaces the bad by the good, without doing violence to old prejudices. International exhibitions and their far-seeing originators have done vast good in turning the downward flow of national taste in this and other countries, and in every branch of art industry their good results are evident, but in none more than in pottery, and porcelain, for it is peculiarly well adapted to foster art tastes. A mass of clay may be formed into a vessel entirely devoid of beauty of form, but yet quite sufficient for the purpose of holding a fluid, or other matter; hence, when it has added to it another qualification, that of pleasing the eye by its beauty of form, color, or decoration, it becomes an art educator, and when this quiet and unobtrusive instructor mixes up with our every-day life, it is sure in the end to succeed, and if well directed will diffuse true artistic taste in every home to which it finds access. Hence it is that the love of pottery and porcelain has a strong hold upon those who have studied it and learned its power as a cultivator of taste for art, and although they are often thoughtlessly ridiculed for it, they are nevertheless right, and in due time the correctness of their taste will be admitted.

As specimens of the progress of the art in England, we engrave four other dessert plates, two from the exhibit of Messrs. Daniells, on page 189, and two, on page 190, from the exhibit of Messrs. Brown-Westhead, Moore & Co. Twenty-five years ago, such work could not have been found in an English pottery; in less than ten years an American pottery will equal, if not excel, such productions.

It is no easy task to select from the extensive contributions of Messrs. Elkington & Co. what will best exhibit the taste and skill manifested in their productions. There is one object, however, which at once arrests the attention of every visitor, for there is no finer work of its class in the whole building. It is a beautiful *repoussé* table. The design and the execution of the whole of the ornamental portions are by M. Morel Ladeuil, who was occupied

nearly three years upon the work. The surface has a circle of figures embodying the dreams of the three figures sleeping below—a minstrel, a soldier and an agriculturist, who are under the influence of the goddess above, in the act of strewing poppies around. It must be admitted that the Messrs. Elkington, with the assistance of their artists, have brought the working of precious, as well as some of the inferior metals to the highest point of perfection. Gold and silver, oxidized metal, bronze and steel, are seen wrought respectively in objects of real artistic value, from a lady's card-case or an infant's christening-cup, to the massive candelabrum or salver, the graceful statue and the glittering armor of chivalry.



DECORATED DESSERT PLATES.

By Brown-Westhead, Moore & Co., Staffordshire Potteries.

In order to do all the justice in our power to so large and varied a display, we engrave, in addition to the *repoussé* table on page 192, one of their bronze groups on page 193, and a vase and dish on pages 195 and 196. The vase is ornamented with allegorical figures and reliefs emblematical of the Sun and Moon, as typified by Apollo and Diana. The four medallions surrounding the centre represent the four Elements. The vase and dish are of silver and were designed by M. Willius.

The history of the origin of the Indian manufacture of shawls is not known, but it is certainly very much more ancient than the data hitherto possessed on the subject would indicate. The oldest records go back to two centuries before the birth of Christ. In the ancient

patriarchal times of the race, and from the Mohammedan epoch up to our own times, the house manufacture of Cashmere shawls appears to have incurred but few vicissitudes; but there is reliable indication that an important market for these goods existed in all parts of the East, and that it flourished in every direction. The tedious and complicated process of manufacture was never in a position to satisfy the demand, and this was the first cause of a great rise in the price of the article. About twenty years ago, under the regency of Gholab Sing, this branch of manufacture underwent a great change by the emigration of the best weavers of shawls in Cashmere, in flight from the oppression of the chief, to British territory in and around Lahore, where they settled and made this neighborhood the centre of a shawl manufacture, which in extent far surpasses that of Cashmere. But the migration of the weavers was not so beneficial to the artistic value of the article. The predominating influence of foreign agents from England, and more especially from France, has supplied a great increase of capital and enormously increased the quantity of the produce; but the pattern begins visibly to lose its originality. Ominous signs of decay are already to be traced in two circumstances: the enormous increase of the price of older shawls, and the competition, now very great, among the few native workers who keep aloof from occidental influence, and deal with their produce among each other. At the head of this national industrial movement stand mostly individual native chiefs. Those among English manufacturing and export firms who sent the best articles were the committees of Madras and the Punjaub, Devisahai and Chamba Mal in Amritsur, Ahmad Shah and Ahsan Shah in Ludhyana; finally, the well-known house of Farmer & Rogers, of London, from whose exhibit we engrave portions of shawls on page 198.

The Punjaub exhibited decidedly the most original patterns and the purest webs; the London house some richer sorts. It is uncertain, from the defective description, to whom the striped shawl patterns belonged; we believe to the Mohammedan firm Ahmad. They indicate a lamentable falling off in this beautiful branch of manufacture. Some six or eight shawls displayed by Farmer &

with the beautiful productions of India, and that by material mechanical improvements established the continental shawl-weaving on a firm basis, the country whose production in this branch is not to be lightly esteemed, was represented at the Exhibition by only one—and that one Scotch—of her manufacturers of shawls. At London, in 1862, there were twelve firms on the spot; at Paris, in 1867, there were only four; in 1873, there was only one—Kerr, Scott & Co., of Edinburgh and London. The shawls sent by this firm do not display the most perfect designs, nor the most successful shades of color, whilst they contain many kinds of wool.

The collection of ware of Indian manufacture gave a fair representation of a native industry. The pieces exhibited are the property of the Indian Museum, in London.

Nearly all of these ornamentally modeled vessels, edged round with fine outlines in profile, bear evidence of their community of origin from the metallic art, which reached such eminent development and importance in India in ancient times. From this art they derive the beautifully winged and fragile handles upon the vessels; the long, narrow necks of the vases, and even the ornaments introduced by paintings here and there, are significant of the same intention, which we find elaborated more perfectly in the Indian silversmith's work. The reason that the prominent peculiarities of Indian pottery which we indicate here were not so strikingly characteristic of any of the exhibited objects, lies in no small degree in the corruption and decadence of Indian manufacture, which has indubitably spread during the last few years over the most civilized portions of the country. With a very just appreciation of the inestimable wealth that lies hidden in the national home industry of the East, the English Government has attempted to counteract this evil by the foundation of the Madras School of Arts, and by the sending out of a Director, the principal part of whose mission consists in the education of the native youth in art industries. The results already obtained are completely satisfactory. A collection of good models has been made, native teachers have been instructed, and the works of the pupils give evidence of very great excellence. The effort to

preserve relics of ancient Indian art led in the same way to the creation of models of the ornamentation of the ancient Hindoo temples, made in the same school, in terra cotta; a number of such ornaments were to be seen in the Exhibition. Besides these, beautifully ornamented Alkarazas and other vessels were exhibited.



"The Great Exhibition, 1876."

PHŒBUS VASE AND DISH.

[The Main Building,

By Eiskington & Co.

The Baroda work—black vessels with inlaid silver ornament—showed most distinctly its derivation from metallic art. Here, as in the flat-shaped vessels, large flowers are the chief part of the design of the ornamentation. A similar combination of pottery and metallic ornament was exhibited in the brown-black vessels sent

from the Punjaub and Azimgurh, generally containing squamiform inlaid silver wire.

The Water-cooler, which we engrave on page 200, and the Bowl on page 201, are taken from the exhibition of the Indian Museum.



TOP OF REPOUSSE SILVER TABLE.

By Elkington & Co.

England may well be proud of the exhibition made by her colonies at our Centennial Fair. India, Australia, New Zealand,

Ceylon, British Guiana, and the far-away settlements on the Gold Coast, the Bahamas, the Bermudas and Trinidad, Queensland and the Canadas, each and all have come to us, their elder sister, proud to show us and each other the evidence of their young, vigorous life. Yet some of these colonies have already reached a maturity when they begin to look forward to being their own masters; and it is likely, before many more years have passed, that the mother-country will assist them to set up governments for themselves. England is now a wiser mother than when she angered us to break the leading-strings. She realizes that her other children, now growing up around her, will some day want to be powers unto themselves; and instead of discouraging, she encourages them in the idea. Such a policy gives the colonies a healthier, manlier growth. When they achieve independence they will have nothing but affection for the mother who nurtured them, and they will stand strong and ever ready to resent any insult that may be offered to her.

It is positively amazing to contemplate the progress which these colonies have made in the last few years. In the Canadian Court we see the largest evidence of this, because from her neighborhood she could make the most general display. There is in this section an evidence of refinement and art-culture, as well as of solid progress that shows a wonderful maturity of civilization. Look where we will, among the ceramics, the textiles, the metal-work, we see this.

In metal-work there is especial excellence. Take, for example, the subject of illustration on page 203. It is a Wrought Iron Gate, manufactured by Messrs. H. R. Ives & Co., of Montreal. We know of no more thoroughly artistic example of this kind in the whole Exhibition, and this is saying a great deal, for England contains some splendid pieces.

Notice with what rare skill solidity has been combined with lightness. Each gate is thoroughly braced by the standards and cross-pieces containing the panels. This first and chief point accomplished, the artist can exercise his fancy upon the decoration. He has chosen a vine as his theme, and has woven it between the uprights in a graceful and symmetrically conventionalized way.

With the same motive he has ornamented the arches formed by the curved braces with a whorl of leaves, tendrils and blossoms, and



[The Main Building.

CASHMERE SHAWLS.
Indian Department.



"The Great Exhibition, 1876."

again the foliation appears in the finials to the uprights and standards. We bespeak for this piece of work a degree of attention

on the part of our readers, not only because of the neighborhood from which it comes, but because of its own intrinsic excellence.

We must now bid adieu to England and her Colonies, the latter of which make really magnificent displays of raw material. Shut out from all the rest of the world, England can enjoy all the productions of the most variable climates by simply drawing upon her speculative sons who have ventured into Arctic regions for furs: Canada to till the soil; the tropics to raise rice, coffee, or sugar; or the antipodes to search for gold or to rear the wool-growing sheep.

It certainly is the very antipodes from New South Wales to Sweden or Norway, but it is easy enough to step from the one to the other in this palace on the Landsdown plateau of Philadelphia. Crowds of people were constantly found around the model illustrations of Swedish and Norwegian manners and customs; whilst those whose interest drew them to the rear of the Swedish court were gratified by seeing the fine trophy composed entirely of Swedish iron. This trophy was designed to represent one of the Viking kings starting off on a marauding expedition on the high seas. In the fore-part of the Swedish court was a fine collection of ceramics.

The group of articles which we engrave on page 204, in variety of form and material give an excellent idea of the character of the exhibit made by the Gustafsberg Company, of Sweden. Here is terra cotta, parian, imitation majolica, and different qualities of porcelain. The large vases on either side of the engraving are, as will be seen on inspection, different views of the same piece, which occupies the place of honor in the Messrs. Gustafsberg exhibit, and is, undoubtedly, the *chef d'œuvre* of the collection. This vase stands about four feet high, and from the foot upwards is one solid piece of porcelain. The general color of the piece is a clear sky-blue of remarkable evenness. The border around the foot, the channels around the lower part of the body, the scroll-work above and the relief-work generally are gilded with gold. The zone around the middle of the vase contains a finely-

painted subject representing the procession of the Arts. The coloring of the figures is very rich and varied, and they are seen with clearness against the back-ground of pure white enamel.

A vase of Persian shape, decorated with figure-subjects of Peace and War, crowns the group. Other vases of different styles and shapes can be seen dispersed throughout the collection. Fine



"The Great Exhibition, 1876."]

WATER COOLERS.
Indian Department.

[The Main Building.

porcelain dinner-services, plainly but richly decorated with bands of color, will be observed also. An excellent beer-mug of cream-colored stone, with blue enamel in relief ornamentation after the German style, is here, and also a ewer of an Urbino pattern in majolica. A fine group called "The Grapplers," and numerous busts and statuettes in parian, will be observed, as also, standing just back of the majolica fruit-dish, a pair of covered vases

in parian of the open-work or basket-pattern which is so much admired.

The basket of silver filagree, which we engrave on page 205, is from the exhibit of M. Trostrup of Norway, and the two card-cases, on pages 206 and 207, are from the exhibit of Signor Emile Forte of Genoa.

The extent of the display made by Italy in various branches of the manufacture of ornaments applicable to personal decoration is altogether so much beyond what the general visitor would



"The Great Exhibition, 1876."]

BOWL.
Indian Department.

(Main Building.

expect, that we anticipate comparatively few persons will have either time or inclination to examine into the details of this remarkable exposition of the industry, chiefly of the cities of Florence and Milan. With the limited space at our disposal it would be useless to attempt to discuss the merits, or even the leading features of the Italian exhibit, arranged for the inspection of the public upon the centre of the court, inasmuch as most visitors would make a point of examining them from the prominent nature of the display, whilst scores, probably hundreds, of articles of jewelry, the production of the skilled workers of other countries for commercial



purposes, equally, perhaps more artistic, though less genuine, would be overlooked.

No person could walk along the Italian court where the mass of the *bijouterie* of Italy is exposed, without being forcibly struck with the immense amount of skilled labor and true artistic power evidenced in the examples exhibited. We doubt whether any other country in the world could have produced such specimens of exquisite handicraft, of fanciful design, of artistic invention; or as a whole, shown so much really good taste, when it is considered to what a fearful lack of taste the manufacturer of these articles has to cater, either in the dealer who stands between him and the public, or in that same public itself: since in few things do we see such an utter want of everything like fixity of principle as in the selection of personal ornaments in gold, silver, and precious stones, or their imitations.

In too many instances we regret to find that the absurd attempt at an absolute imitation of natural forms does much to detract from the real merit of otherwise excellent examples. This is peculiarly manifest in the articles chiefly intended for exportation. It is, however, in the very highest class of jewelry, and the combination of precious stones with gold and silver, that the true strength of the Italian designer and art-workman in this *specialité* is most evident. The works exhibited by Salvo, Bellezza, Castellani, and Policarpo would alone suffice to prove this. In Castellani's display there are a few old friends of 1873, not in any degree unwelcome; whilst there is the same unrivalled power in smaller articles, carried to a still greater extent, which so thoroughly awakened public attention in the Vienna exhibition. Some of the brooches, bracelets, &c., in oxidized silver, would defy Cellini himself to surpass them. One exquisite little *bijou* is a smelling-bottle, decorated with a Cupid and an interwoven arrangement of ivy. Anything more perfect it is impossible to conceive. Another, too, is a brooch, in oxidized silver, of a guardian angel, the arrangement of whose wings, in conjunction with a cross which forms the base of the composition, is most happily managed.

Bellezza's works are not a whit inferior, though somewhat different in certain points. He exhibits, amongst a variety of smaller examples of his art, a *Prie-Dieu*, in gold, silver, and enamel. The mosaic imitations are of great beauty, but the large ornament at the back is very much out of proportion, and gives a littleness to the other details of the work by contrast.



"The Great Exhibition, 1876."

GROUP OF ARTISTIC POTTERY.

[The Main Building.

By the Gustafsberg Co., Sweden.

Francati and Santamaria exhibit bracelets of extraordinary beauty in design and execution, as also enamels of great excellence. Our notes abound in quotations of examples of excellence in gold and silver filigree work, of bouquets in paste and diamonds, of imitations of precious stones and gold and silver for ecclesiastical purposes; as also of theatrical jewelry, arms, and armor.

Seal handles, snuff-boxes, cigar-cases, and the thousand-and-one articles comprised under the general head of "*Nécessaires et Trousses de Voyage*," and "*Articles de Fantaisie*," with which the Italian court is filled to repletion, also claim attention, which can only be given here by urging the necessity for more attention on the part of the producers of these articles in America to the activity of the Italian, French, and English manufacturers; and above all, the necessity for a better special education for our artisans engaged in their production. This last is the great lesson taught to the employers of skilled labor in America, and which sooner or later they must attend to. If the workman of Newark, N. J. was lifted



"The Great Exhibition, 1876.") **BASKET IN FILIGREE SILVER.**

[The Main Building.

By Trostrup of Norway.

more towards the dignity of the artist by early and sound instruction in the artistic principles of his trade, there is no reason why he should be a whit behind his fellow-worker of the Italian *botege*.

Probably the great fault of the Italian jewelry is its excess of ornament; and, frequently, the superabundance of color introduced by the agency of enamel, or colored stones. In this, however, we see the peculiar national genius of the producers; since much the same remark has been made of nearly every department of Italian industry.

The articles we engrave on pages 208 to 212, are from the exhibits of Signors Geraldini, Salvo, and Bellezza, which give

nearly as full a representation of this branch of Italian industry as our space will permit.

But the *artist* of Italian workers in the precious metals is Signor Castellani of Rome, a necklace by whom we engrave on page 213. This necklace is a correct imitation of the Etruscan method of working in gold.

The old Etruscan artists used mechanical agents which are now



CARD-CASE IN FILIGREE SILVER.

By E. Forte of Genoa.

unknown to us, and were able to separate and join pieces of gold hardly perceptible to the naked eye. Modern workmen have failed in their attempts exactly to imitate the old ornaments. Nor do we know how the ancient processes of melting, soldering and wire drawing were carried on. We are left, therefore, to admire not alone the elegance and beauty of the Greek and Etruscan granulated and filigree works in gold, but the mode of execution also.

In the East Indies, at the present day, may be frequently seen

wandering workers in gold and silver who carry their tools about with them, and, where employment can be found, soon transform coins and bits of the precious metal into filigree jewels or ornaments, somewhat resembling the antique, whilst still following



CARD-CASE IN FILIGREE SILVER.

By E. Forte, of Genoa.

their own national and traditional style. These may give us some idea how the early Greeks and Etruscans worked.

Signor Castellani has taken great pains for many years in endeavoring to discover the primitive mode of working the delicate gold ornaments which have been discovered in the tombs. He says that the means of soldering was the first problem: and the almost invisible grains of gold, like fine sand, which give such a distinct character to Etruscan ornaments, presented nearly insurmountable

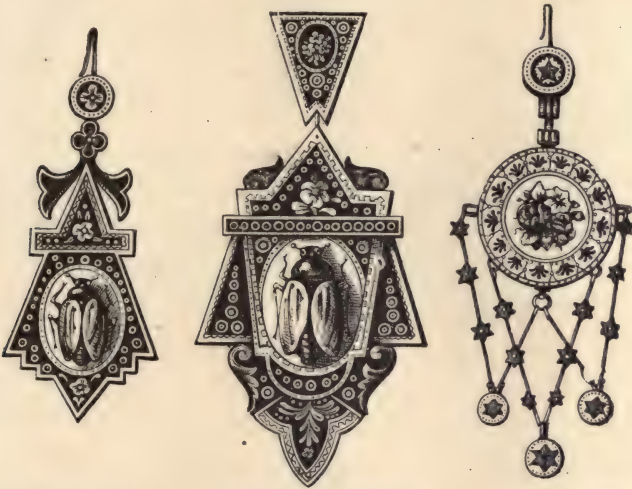
difficulty. He read the treatises of mediæval goldsmiths, and the earlier books of Theophilus and Pliny; he inquired everywhere in Italy of all classes of jewelers; he made innumerable attempts, with all kinds of chemicals and the most powerful solvents, to compose the proper solder. At last he found some of the old processes still employed in a remote district, hidden in the recesses of the Apennines far from the great towns. Bringing away a few workmen, he gave them much more instruction and at last succeeded, not perhaps in equalling, but certainly in rivalling, the brooches, chains and other specimens of ancient Etruria and Greece.

The revival of learning in Italy was accompanied by other circumstances which had a powerful influence on the arts, and particularly on the sumptuary arts of the century. While the nations of Europe were more or less convulsed with war, it was not easy or possible for the inhabitants, even the wealthy, to do much in furnishing dwelling-houses with any kind of comfort. Rich furniture consisted in a few costly objects and in hangings, such as could be carried about on sumpter-horses or in wagons, and, with the addition of rough benches, tables and bedsteads, could make bare walls look gay and comfortable, and offer sufficient accommodation in the empty halls of granges and manors seldom lived in, for the occasions of a visit or a temporary occupation.

A beautiful example of the wonderful wood-carving for which the Italians have been famous since mediæval times is the Book-case exhibited in the Italian Court. It is designed and carved by Prof. Egisto Gijani, of Florence, after the style practised in that city in the fifteenth century. The material is European walnut, very highly polished. The base and plinth are inlaid with panels composed of figures, grotesques and masques carved in very high relief, with supporting columns at the sides of a singularly ornate design. A group of cupids standing upon a vase support another vase from which the slender shaft of the column proper rises. Surmounting the top is a symbolic group of figures supporting a medallion bust of Lincoln.

It is in looking at such work as this that we realize how greatly the knowledge of what is fine and beautiful in decorative carving in

wood is due to the opportunity for study and training which a country like Italy, so rich in the best examples of this art and of art in general, can afford. The study of the wonderful carvings at Perugia or of similar works of the highest excellence inspires the artisan to attempt to imitate them. Even if he fails he has exercised certain art impulses in the right direction; and this process acting through the individual on the masses, has occasioned that modern *Renaissance* that, awakening to the glory of mediæval art, is now manifesting itself throughout Italy in two ways—the one in the



["The Great Exhibition, 1876."]

GOLD EARRINGS.

By Geraldini, of Rome.

[The Main Building

astonishingly clever imitations of *tricento*, *quattrocento* and especially *cinquecento* work, which is calculated to deceive even the shrewdest connoisseurs by the likeness to the original; and the other in an endeavor to do true, honest work, using the old masters simply as instructors who shall guide the student and encourage him to develop his own ideas, and not become a servile imitator.

The immense influx into Italy of wealthy amateurs and ignoramuses, the one anxious to get good specimens of good mediæval work, and therefore willing to pay liberally, the other determined to have something "antique," because it seems to be the correct thing to have, and as a consequence ready to pay exorbitant prices, has

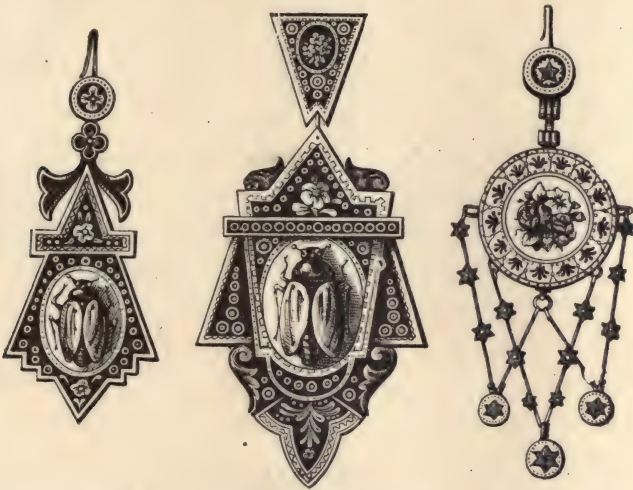
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["The Great Exhibition, 1876."]

GOLD EARRINGS.

By Geraldini, of Rome.

[The Main Building]

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given a truly astonishing impulse to the trade of the dealer and the trade of the imitator. Rich as Italy undoubtedly was in art-treasures in those glorious days when art was still religion and religion found expression in art, if but half the stuff annually carried off from her cities since then were genuine, she would long ago have been stripped of her glories; instead of which she is to-day a seemingly inexhaustible mine, growing richer rather than poorer to the intelligent searcher after art-treasures.

Weapons of defence and of offence are, and must have been among the very earliest things made; nor is it necessary to attribute this fact—as some have—to the evil passions of



CROSS.

By Salvo & Sons, of Genoa.

humanity. To obtain food from slain animals of the field and forest and to defend himself from the attacks of ferocious animals were the first necessities of primeval man. Hence, in almost every deposit where pre-historic remains are buried we find clubs, hatchets, arrows or the like. Nor are these always rude in manu-

facture: ornament of some kind seems to have been coeval with protection; and the celt and hammer head of even the Stone Age often assume graceful outlines not essential to the practical purpose for which the weapon was made.

Leaving these mysterious ages and passing over, it may be, thousands of years, historic records prove the care and labor spent upon the décoration of arms and armor from the first periods of the

Egyptian, Assyrian and Greek peoples. The painted tombs at Thebes and the sculptured walls of the palaces at Nineveh have supplied us with many examples of armor and weapons, reaching back to the fifth or sixth Egyptian dynasty, before the exodus of the Israelites. Classical Greek authors, and especially the poets, from the days of Hesiod and Homer, are full of notices and allusions.



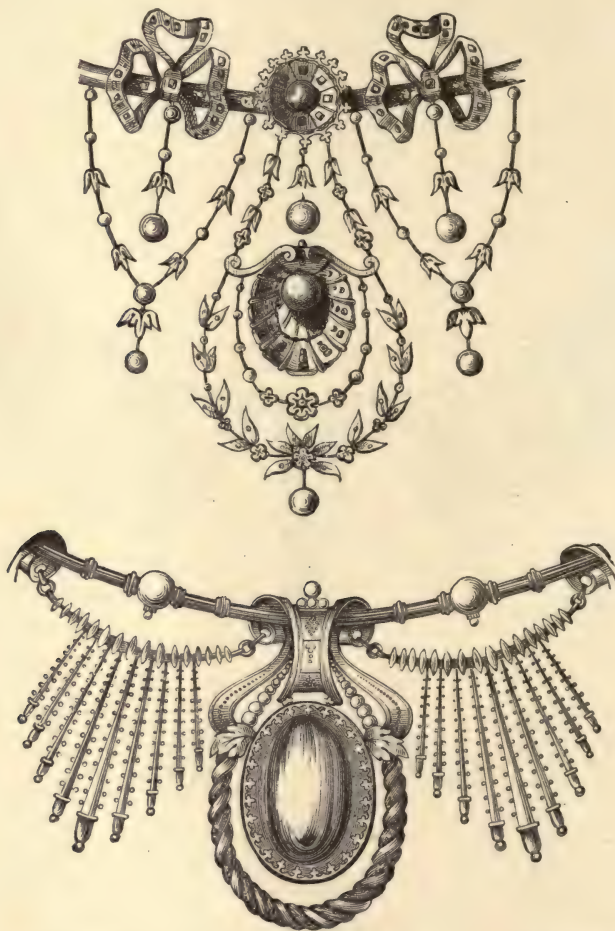
"The Great Exhibition, 1876."]

NECKLACE.
By Bellezza, of Rome.

[The Main Building.

The golden armor of Glaucus, the shield of Agamemnon and the wondrous armor of Achilles, although perhaps poetically to some degree imagined, must have been described from real types and examples which Homer had himself seen. Nor are we left, scarcely a century or two later, merely to poetical descriptions from which we may learn what ancient armor and the ornaments of it were. Besides the information which we derive from vases and bas-reliefs, various fragments have been found in Greek and Etruscan tombs

clearly showing the artistic and beautiful decoration which was bestowed on armor. Once, when a tomb in Etruria was opened, the buried chieftain was seen clothed in full armor and resting on a couch



"The Great Exhibition, 1876."

JEWELRY.
By Bellezza, of Rome.

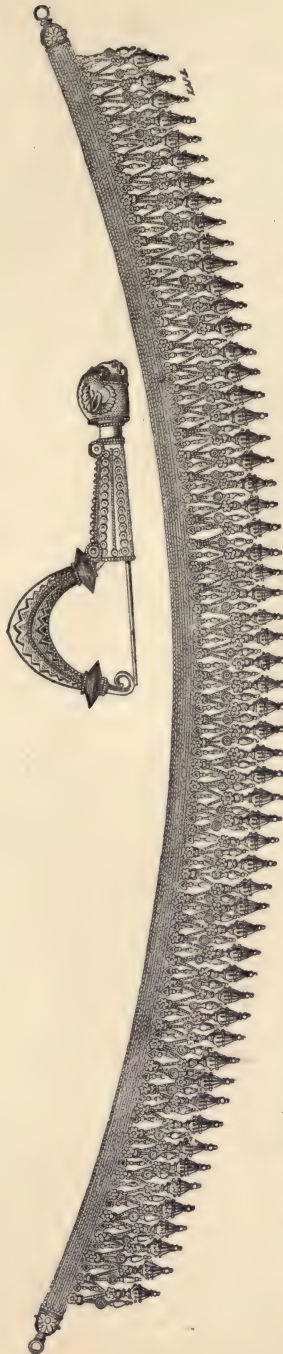
[The Main Building.

of bronze, and, although the skeleton quickly mouldered into dust and much of the iron perished also on exposure to the air, enough was left, and especially of the rich gold ornaments, to enable us to form a complete idea of the living warrior. Two small portions of the shoulder-pieces of a bronze Greek breastplate are in the British

Museum; and it is hardly possible to conceive any art or workmanship more admirable than that which first designed and then executed the figures which decorate these pieces in high relief.

The full suit of armor, entirely of plate iron, was not known until about the year 1300. It was first worn in Italy and with its introduction came the opportunity also of much decoration. At first this consisted chiefly of flutings, hammered out, with the addition sometimes of other ornaments.

But, before



[The Main Building.

NECKLACE.
By Castellani, of Rome.

["The Great Exhibition, 1876.]

the reign of Henry VIII, far greater labor and much higher artistic decoration were applied to armor. The helmet and every other part were covered with embossed figures or arabesques, engraved, chased and damascened with gold and silver; the shields and sword hilts especially were often carved with very complicated subjects in bas-relief. The richest armor was executed in Italy, but there were also artists of renown in Germany, particularly at Augsburg, and in France.

The engravings we present on pages 217 and 219 are from the Italian exhibit and are electros of the shield of Henry IV, and of a Cellini helmet. Italy also has a fine exhibit of majolica-ware, and copies in terra cotta of well-known subjects sculptured in marble, but we must cross the main avenue and do but scant justice to China and Japan, contenting ourselves by illustrating, on pages 220 and 221, a couple of bronze vases and a céladon vase from Japan.

Some of the Oriental bronzes, especially the Chinese or Japanese, are admirably characteristic in design and perfect in execution. The finest Japanese are especially distinguished by extreme lightness. Some of them, being lifted, cause even a singular illusion; in first taking them into the hand one is prepared to raise a piece of metal, and it is found to be almost as light as glass. In their bronzes, the Japanese have proved themselves to be, as in some other manufactures, most intelligent and expert artists. Nearly all their best works are modeled carefully first in wax and treated in so masterly a manner, so daintily also and minutely finished with the tool, that objects comparatively common—such as baskets and small stands—are marvels of truthful reproduction.

The period of the first manufacture of porcelain in China is involved in complete obscurity; we must be content to allow it a very great antiquity and admit that excellence was long ago arrived at. The official annals of the Chinese places the invention some two hundred years at least before the Christian era.

Many attempts have been made to classify the various kinds of Chinese porcelain, a task of extreme difficulty. The dragon, with five, four or three claws, is a favorite subject of decoration; also, the kylin, the dog, the spotted deer and sacred birds. The most beautiful color is the turquoise blue. Yellow is the imperial color, and a fine ruby is generally found on the highest quality of egg-shell plates. The old sea-green—the true céladon—is greatly valued. The crackle vases, when good and old, are always sought after; and though the cause of the crackles is shown to be the unequal expansion of the glaze on the paste, we do not exactly know how they were produced.



"The Great Exhibition, 1876,"]

CABINET.

[The Main Building,

By Gijani, of Florence.

The Chinese make some wonderful porcelain, to which they give innumerable forms and every gradation of color. The decorative taste and skill of the artists of "the Celestial Empire" know no limits. Their chief aim is to imitate, with more or less capricious variation, some natural object. They study flowers and fruits, beasts and birds, tree-trunks and empty shells, and refresh the countless subtleties of their fanciful imaginations with the realities of existence. It is true that they have a tendency to the monstrous and the distorted which offends our educated eye and better judgment; yet, some may still argue that their grotesque dragons and reptiles, their fish and gigantic birds, are but traditional representations of animals which, according not only to eastern story but to the facts made known by modern science, once trod and crawled upon the earth or swam across the seas.

Japanese porcelain bears a resemblance to that of China, but with a little experience can be easily distinguished. It is a more brilliant white and the clay is of a better quality; the designs are more simple and the decorations less overloaded; the animals are not so monstrous and the flowers more in accordance with nature. Japanese porcelain does not stand the heat of the fire so well as the Chinese.

The oldest kind of Japanese ware is of a quaint shape with curious embossed figures, painted on a white ground in red and blue, the paste not being of a good quality. The most perfect production is the fine vitreous porcelain, the paste of which is prepared with extreme labor. It is so white and thin as to be perfectly translucent; the glaze so equal and clear and so colorless that one can scarcely believe it to be the work of the potter.

Except in its pottery and silverware, the first chamber of the Danish Court presents nothing, whilst the second and third chambers are sparsely filled with more terra cotta and several specimens of raw material. From the exhibit of the Widow Ipsen, of Copenhagen, we engrave, on page 225, a pair of vases which convince us that art has found a home among the snows of Denmark; and, on page 226, an engraving after Thorwaldsen's Ganymede, a small replica of which is in the Danish Court. The tea-service in silver which we engrave

on page 227 is from the exhibit of M. Christisen, of Copenhagen, who made a large exhibit of solid silver and partly oxidized silver-work at the French and Vienna Exhibitions, where he obtained the highest awards for his elegance of design and beauty of manipulation.



"The Great Exhibition, 1876."]

HELMET.
Italian Department.

[The Main Building.

Next to the Danish Court is that of Egypt, in which is the finest cabinet-work in the whole Exhibition. The maker and exhibitor Guiseppe Parvis, of Cairo, is an Italian, long settled in Egypt, who occupies the post of furniture manufacturer to His Highness the Khedive.

This cabinet engraved on page 229 is composed of the finest ebony, polished till it resembles jet, in which are inlaid masses of ivory and rare pieces of mother-of-pearl, carved with all the patient labor and minuteness for which the East is famous, the whole following a design of extraordinary intricacy and elaborateness. The most remarkable feature of this work is its finish. Not a joint is anywhere visible; the bits of ivory or mother-of-pearl are so nicely fitted together that they seem like solid pieces of a marvelous bigness. The longer one looks at the design, the more intricate it seems to become. The heads surrounding the grotesque mask in the central panel come out with greater distinctness, and new forms reveal themselves in the frieze and ornamentation to the panels on either side. Surely when the artisans of Egypt can produce such work as this, it is too soon to say that the glory of the East has departed.

This fine example of the cabinet-maker's skill is built of ebony. It is inlaid with ivory and mother-of-pearl, in those highly effective patterns that are at once the admiration and the wonder of other nations. Every detail has been worked up and studied from the specimens of the best period of Arabic art. Nothing could be more effective than the result. There is but little carving—none indeed in high relief—and yet an effect has been produced more than any carving. The richness of the tracery in the central panel is particularly fine, and taken as a whole it deserves commendation of the highest description. The possessor of such a piece of work as this Cabinet would never tire of it, simply because the harmony of its parts would be constantly asserting themselves, and, like in a good picture, new beauties would constantly be revealing themselves.

The form of decoration, consisting of fantastic combinations of flowers, fruits and branches, or, indeed, of almost any intertwining of graceful forms and lines in a repetition of the same pattern, is a characteristic of Moorish architecture that has been given a distinctive name—*Arabesque*. Ornamentation of this kind, either in sculpture or painting, has been found wonderfully effective;

out it requires the exercise of the nicest discrimination. The perfection of its use is to be found in the Alhambra, the most perfect specimen of the best Moorish architecture existing at the present



"The Great Exhibition, 1876."

SHIELD.
Italian Department.

[The Main Building.]

time. Its walls are particularly rich in arabesques of various patterns, some of them of an astonishing intricacy and beauty. From Arabia the use of this style of ornamentation spread to Europe, and thence over the civilized world. We see examples of it every

day in the ordinary decorations of our walls and houses and in the ornamentation of our vessels in common use. Painters and



"The Great Exhibition, 1876."]

VASE IN BRONZE.
Japanese Department.

[The Main Building.

sculptors find it of the greatest assistance in making effective frameworks for their productions. Raphael's famous Arabesques

in the Vatican will be recalled by many of our readers; and the use made by Kaulbach, quite recently, of some of these forms in his fresco painting is familiar to many. For a cabinet-maker a



"The Great Exhibition, 1876."

VASE IN BRONZE.
Japanese Department.

[The Main Building.

knowledge of the best specimens of these beautifully artistic designs is of great advantage. No better treatment of precious woods in *marqueterie* has been found than to follow, or, rather, to learn from, the forms designed by the old Arabians. Beautiful as is

the exact imitations by the Florentines and Indians of natural objects such as birds, flowers, etc., their copies, as a rule, show poverty of invention; whereas, the Moorish work, while sufficiently conventionalized, shows a freedom from mannerism and richness of fancy that can hardly be too highly commended.

It is not possible to say at what date gold and silver, the two precious metals, were first worked into ornaments or used as coin or other circulating medium. In the book of Genesis we read that Abraham when he went out of Egypt was very rich, not only in cattle but in silver and gold; and golden earrings and bracelets are spoken of in the twenty-fourth chapter. We believe that no coined gold or silver has been found in Egypt or in the ruins of Nineveh; and as a means of exchange it was probably at first used by weight.

But there is ample evidence of the very high antiquity of gold ornamental work. Many proofs may be seen in the paintings of Egyptian tombs, and (to name no more) there was a remarkable set of gold ornaments shown at the great Exhibition of 1862. These were found at Thebes in the tomb of a queen who reigned about 1500 years before the Christian era. Among them was a poinard with a gold blade on which was engraved a combat between a lion and a bull: the cartouche contained the name of Amosis, son of the queen, and the first king of the eighteenth dynasty. There were a diadem also, each extremity of which has a couching sphinx; and a square pectoral brooch, set with colored stones; a massive bracelet, ornamented with a repoussé figure upon a ground of lapis-lazuli; and a boat of massive gold upon four wheels of bronze, with silver rowers. Upon this last is the name of king Rameses, the father of Amosis. The most astonishing of the relics was a beautiful gold chain, of woven pattern and admirable workmanship, three feet long.

That the birth-land of Art does justice to herself at our International Exhibition is admitted on all sides, and there would be no difficulty whatever in filling several large volumes with illustrations from the Egyptian, Japanese and Chinese courts; but



"The Great Exhibition, 1876."

VASE IN PORCELAIN.
Japanese Department.

[The Main Building.]

as this is not the place to ride a hobby we shall direct attention to the specimens of modern Egyptian gold work, engraved on pages 231, 232 and 233, and ask the reader to notice the equally high artistic design of the punch-bowl which we engrave on page 238 from the exhibit of Sasikoff of St. Petersburg and Moscow. The set is remarkable, being gilt and inlaid in enamel, with red and black ornaments. Mr. Sasikoff is goldsmith to the Imperial Court at St. Petersburg, and it is pleasing to observe that he has been stimulated to such superb results. But before entering Russia we have passed through the Spanish Court, where there is a liberal exhibit of the textile fabrics of Spain; its wines, woods and minerals. From the exhibit of F. Zuloaga & Son, of Madrid, we engrave on page 235, a plaque of iron; the same firm also exhibits a beautiful collection of damascened iron. Damascening is a very beautiful mode of decorating iron or steel; by this term is generally understood the art of cutting out thin plates of metal and fixing them upon another metal of different color and usually of an inferior quality, either by pressure or by grooves previously incised upon the surface to receive them. Damascening is partly mosaic work, partly engraving, and partly carving. In the first, the pieces are inlaid; in the second, the metal is indented or cut in intaglio; in the last, gold and silver are wrought into it in relief.

Usually, the process of damascening differs according to the hardness of the metal. When iron is used, the whole surface is covered with fine incisions, upon which the design is inlaid by means of gold or silver wires; these are fastened by strong pressure or beaten in with a hammer. The piece is then polished with a burnisher, which not only fixes the gold or silver more firmly, but obliterates the incisions and restores the original polish. When finished, the damascening resembles a flat embroidery.

This art of damascening attained its highest perfection in Europe in the sixteenth century: Venice and especially Milan were famous for it. Not only armor and weapons, but caskets, tables, and cabinets were damascened with ornaments and arabesques

of the most exquisite devices. One of the most admirable specimens known to us of this period is a shield, attributed to Benvenuto Cellini.

Turkey must have borrowed its art of pottery from the Assyrians or Babylonians, and not have awakened to what was being done in her neighbors' workshops; for, looking at her exhibits of ordinary household ware, we fancy ourselves in the midst of the sun-dried clay vessels which fulfilled the needs of the Persians ere her art arose, and shape, rendered facile by the introduction of the potter's wheel—who knows whence?—preceded ornamentation; but, judging from Turkey's exhibit, in this branch of industry, we are forced to the



"The Great Exhibition, 1876."

TERRA COTTA VASES.

By Madame Ipsen, of Denmark.

[The Main Building.

conclusion that she has not done herself justice in this department. We engrave a few specimens from its exhibit on page 237.

Russia makes a small exhibit of pottery, of which we engrave a few examples on pages 239 and 240.

No evidence or proof which may be relied upon reveals to us the time when the art of making glass was discovered, or the nation which first improved it. The old story told by Pliny is this: that some Phœnician merchants having disembarked near the mouth of the river Helus, cooked their food upon the shore, and having piled up some lumps of natron—vitreous stone—upon the sand, the stones and the sand, softening under the heat and mixing, became a trans-

parent and glassy mass. Chance probably did lead to the original production of this material, and there were various circumstances connected with very early manufactures, especially of pottery or the extraction of metals from their ores, which might have caused it. We must be content to learn that the art of glass-making is to be traced to a most remote antiquity.



GANYMEDE, AFTER THORWALDSEN
Danish Court.

Egypt supplies us—as in many other branches of science and art—with the first positive evidences of glass-making. Sir Gardner Wilkinson speaks of glass bottles containing red wine represented on monuments of the fourth dynasty—more than four thousand years ago—and in the tombs of Beni-Hassan, which date from the same period, there are paintings which show the process itself of glass-blowing. A glass bead has been found, bearing the name of a

queen who reigned nearly fifteen hundred years before the Christian era. Greek and Latin writers describe statues and obelisks ten,



"The Great Exhibition, 1876."

TEA-SERVICES IN SILVER.

[The Main Building.

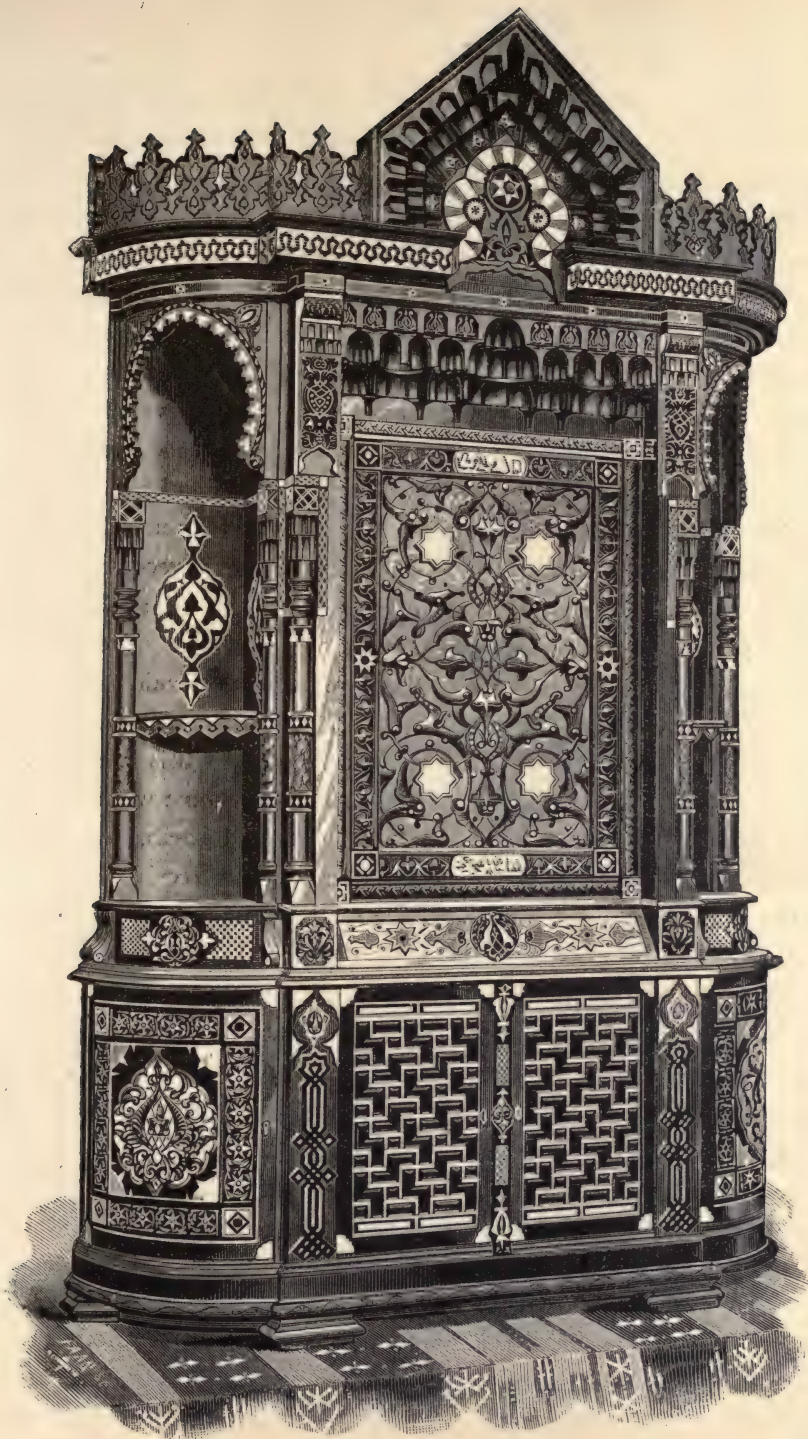
By M. Christensen, Copenhagen.

thirty, and even of sixty feet high made of one, three or four emeralds ; these were undoubtedly green glass

Next in date to the earlier Egyptian examples is a vase of transparent greenish glass found at Nineveh. On this is an inscription, bearing the name of a king who lived about B. C. 700. Fragments also of variously colored glass have also been discovered there. Beads were, probably, among the first products of Egyptian or Phœnician workmen; and, as in modern times, were used for barter not only with the barbarous nations of the interior of Africa, but with those of Western Europe.

The Phœnicians and Egyptians carried their art into almost every country bordering upon the shores of the Mediterranean; and we can scarcely doubt that glass vessels were very anciently made in Greece, in the islands of the Archipelago, in Etruria and in Sicily. The beautiful little vases which may be seen in almost every national collection, and which have been found in the cemeteries of Italy and Greece have, however, a similarity of character which would lead us to suppose that they were brought from a few chief centres of the manufacture. These vases are of different colors, generally blue; usually with surfaces ornamented by bands of white, yellow or turquoise, forming zigzag lines, incorporated with the surface though not penetrating through the entire thickness. The form of by far the greater number is Greek rather than Egyptian or any other oriental type.

It has been said by some authors that glass was not imported into Rome until the time of Sylla; be this as it may, it is certain that the art of glass-making had made great progress before the reign of Augustus, and vessels of all kinds, whether for use or decoration, were in high estimation. Glass has been found in windows at Pompeii. The Romans knew how to stain glass, to blow it, to work it on a lathe and to engrave it. Perfect examples of fine Roman glass are, as may easily be understood from its fragile nature, of extreme rarity; but the quantity once existing there in the first and second centuries must have been enormous; prodigious numbers of fragments—and these of pieces rivaling in excellence of workmanship the most famous which have been preserved—are dug up year after year in the city or in the neighborhood of Rome.



"The Great Exhibition, 1876."]

CABINET IN EBONY.
Egyptian Court.

[The Main Building.

A large proportion of antique Roman glass is found to be brightly iridescent, displaying all the colors of the rainbow with dazzling intensity; red, orange, green and pink shining out in prismatic colors, like the inside of a pearl-oyster shell. This iridescence is caused by a decomposition of the outer surface.

In the Austrian Court, at Messrs. Lobmeyr's exhibit—the best exhibit of glassware in the Exhibition—there arrived just before the close of the Exhibition a few specimens of iridescent glass; the method of doing this has only recently been rediscovered by M. Lobmeyr. It is impossible to illustrate this glass, and, except as in above paragraph, it is impossible to explain the peculiarity.

The luxurious court of Louis XIV was especially noted for the magnificence of its table appointments; and in more recent times it has come to be almost a test of refinement that a lady shall secure for the inmates and guests of her house a pleasant hour over the principal meal of the day, when the cares of the morning shall be laid aside, and all the surroundings shall add to the gratification of the palate. No single element is so necessary to this result as a pleasant light. The brilliancy of gas, desirable in some ways as it is, has great drawbacks. Its light is glaring and harsh, and when thrown into the eyes of the diner is extremely disagreeable. So too is the heat which, as the meal goes on, a large chandelier begins to radiate. Then, too, the position of the light, directly above the heads of the guests, is very amendable. To meet these objections, we may suppose, M. Lobmeyr has designed the *Candelabra-Épergne*, which is given on page 245. A glance will show how many requisites are united in this admirable *Épergne*. It stands upon the centre of the table, holding a dozen wax or spermaceti candles, whose soft light is equally shed on every side. The top is a bowl for flowers, while the larger dishes below may be used either for flowers or fruit, according to the taste of the hostess. The shape of the *Épergne* is such that it does not interrupt the vision—a capital point for it is frequently disagreeable to be shut off from your *vis-a-vis*. The candelabra are simple and strong-looking, not liable to break. The ornamentation is quiet and effective. If we add

to the Épergne a pair of gas-burners fastened against the side of the wall, at such a height as not to be offensive to the eyes of the guests at table, we shall have the perfection of light in our dining-room.

The further selection which we make to engrave from this noble exhibit are on pages 244 and 245.

Our good grandmothers and, in some instances, our mothers, washed the cups and saucers themselves after the evening meal, and the guests sat by and chatted while the sweet house-wifely action was going on. But now, because ser-



[The Main Building.

GOLD NECKLACE.
Egyptian Court.

"The Great Exhibition, 1870."

vants are careless, we are told that we must be content to look at the odd and pretty bits of china that we may possess as curiosities too precious to be used, and take our meals off sets any piece of which can be replaced if by any chance it gets broken.

All this should be changed. With a little care and trouble the dinner-table could be made artistically beautiful. For example, with one of these beautiful dishes of Lobmeyr's made to answer some trifling purpose at dessert, a refining and artistic tone would be

given to all that portion of the meal. One of the pieces on page 244 is a crater vase with handles, and is probably intended merely for ornament. But all the other pieces are suitable for table furniture, either as card-receivers or as receptacles for dainty and choice



"The Great Exhibition, 1876."

NECKLACE AND EARRINGS.

Egyptian Government.

[The Main Building.

confections at dessert. And in this connection we may say that we trust the time is rapidly approaching when people generally will open their eyes to the fact that it is within the power of every one to make the dinner-table something more than a board from which to feed,—to beautify it so that it may be æsthetically attractive.

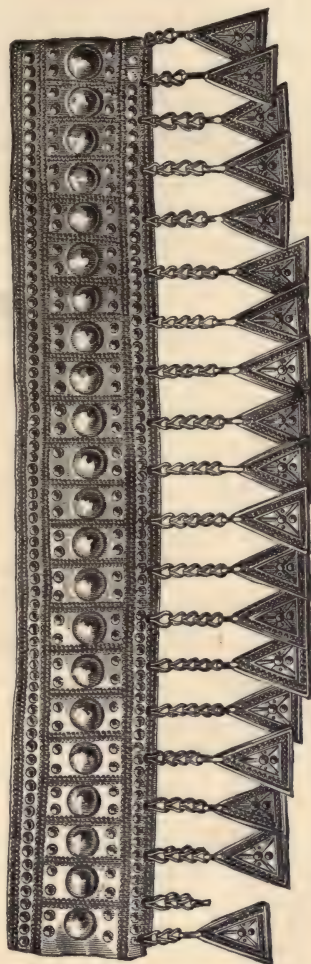
The sooner the absurd custom of putting down upon the table only certain dishes of a conventional shape containing certain meats, and removing them as soon as they have done their purpose—the sooner this absurd custom is done away with the better.

There is not a household so poor that has not some ornamental dish or vase in china or glass that would answer a far higher and better purpose if used to grace the board at meals than if left upon a mantel-shelf or behind a glass simply to be looked at.

Tapestry is neither real weaving nor true embroidery, but in a

really a web, having both warp and woof, but upon a series of closely set fine strings.

From the way in which tapestry is spoken of in Holy Writ we may be sure that the art is very old; and if it did not take its first rise in Egypt, we are led by the same authority to conclude that it



The Main Building.

BRACELET.
Egyptian Court.

"The Great Exhibition, 1876."

manner unites in its working those two processes into one. Though wrought in a loom and upon a warp stretched out along its frame, it has no woof thrown across those threads with a shuttle or any like appliance, but its weft is done with many short threads, all variously colored and put in by a needle. It is not embroidery though so very like it, for tapestry is not worked upon what is

soon became successfully cultivated by the people of that land. The woman in the book of Proverbs says: "I have woven my bed with cords. I have covered it with painted tapestry, brought from Egypt." We find, therefore, not only that it was employed as an article of household furniture among the Israelites, but that the Egyptians were the makers.

From Egypt, through western Asia, the art of tapestry-making found its way to Europe, and after many ages at last to England. Among the other manual labors followed in religious houses this handicraft was one; and monks became some of the best workmen. The altars and the walls of their churches were hung with tapestry. Matthew Paris tells us that among other ornaments which, in the reign of Henry I, abbot Geoffrey had made for his church of St. Alban's were three reredoses; the first a large one wrought with the finding of the body of St. Alban; the other two figured with the parables of the man who fell among thieves and of the prodigal son. While in London, in the year 1316, Simon, abbot of Ramsey bought looms, staves, shuttles and a slay: "*pro weblomes emptis xx^s. Et pro staves ad eadsem vj^d. Item pro iiij shittles pro eodem opere ij^s vj^d. Item in j. slay pro textoribus viij^d.*" Collier, in his history, quotes a letter from Giffard, one of the commissioners for the suppression of the smaller houses, written to Cromwell, in which he says, speaking of the monastery of Wolstrobe, in Lincolnshire: "Not one religious person there but that he can and doth use either imbrothering, writing books with very fair hand, making their own garments, carving, painting, or graving, etc."

We may collect from Chaucer that working tapestry was not an uncommon trade; among his pilgrims he mentions in the prologue,

An haberdasher and a carpenter,
A webbe, a dyer, and a tapisser.

Pieces of English-made tapestry still remain. A fine though greatly damaged specimen is at St. Mary's Hall, Coventry, representing the marriage of Henry VI.

The art of weaving tapestry was successfully followed in many

parts of France and throughout ancient Flanders, where secular trade-guilds were formed for its especial manufacture in many of the towns. Several of these places won for themselves an especial fame; but so far, at last, did Arras outrun them all that arras-work came to



"The Great Exhibition, 1876."]

PLAQUE OF IRON.

[The Main Building.

By Zuolaga, of Madrid.

be the common word, throughout Europe, to mean all sorts of tapestry. Thus the fine hangings for the choir of Canterbury Cathedral—now at Aix-en-Provence—though probably made at home by his own monks and given to that church by prior Goldston in 1595, are spoken of as arras-work: "de arysse subtiliter intextos."

Arras is but one among other terms by which, during the middle

ages, tapestry was called. Its earliest name was Saracenic work—"opus Saracenicum"—and, at first, tapestry was wrought as in the east, in a low or horizontal loom. The artisans of France and Flanders were the first to introduce the upright or vertical frame, afterwards known abroad as "*de haute lisse*," in contradistinction to the low or horizontal frame called "*de basse lisse*." Workmen who kept to the unimproved loom were known, in the trade, as Saracens, for retaining the method of their Paynim teachers; and their work, Saracenic. In the year 1339, John de Croisettes, a Saracen-tapestry worker living at Arras, sells to the Duke of Touraine a piece of gold Saracenic tapestry figured with the story of Charlemagne: "*Jean de Croisettes, tapissier Sarrazinois demeurant à Arras, vend au duc de Touraine un tapis sarrazinois à or de l'histoire de Charlemaigne.*" The high frame, however, soon superseded the low one; and among the pieces of tapestry belonging to Philippe, Duke of Bourgogne and Brabant, many are especially entered as of the high frame, one of which is thus described: "*ung grant tapiz de haulte lice, sauz or, de l'istoire du duc Guillaume de Normandie comment il conquist Engleterre.*" A very fine example is still to be seen in the collection at the Louvre, representing the history of St. Martin.

With the upright, as with the flat frame, the workman had to grope in the dark a great deal upon his path. In both, he was obliged to put in the threads on the back or wrong side of the piece, following his sketch as best he could behind the strings or warp. As the face was downward in the flat frame, it was much less easy to observe and correct a fault. In the upright frame he might go in front and with his own work in open view, on one hand, and the original design full before him, on the other, he could mend as he went on, step by step, the smallest mistake, were it but a single thread. Put side by side, when finished, the pieces from the upright frame were in beauty and perfection far beyond those from the flat one. We can scarcely particularize the details in which that superiority consisted, for not one single flat sample is to be identified as certain from evidence within our reach.

When the illuminators of manuscripts began to put in golden shadings all over their painting the tapestry-workers did the same. Such a manner cannot be relied on as a criterion whereby to judge of the exact place where any specimen of tapestry had been wrought, or to tell its precise age. To work figures on a golden ground and to shade garments, buildings and landscapes with gold, are two different things. Upon several pieces at South Kensington, gold



"The Great Exhibition, 1876."

TURKISH CROCKERY.

[The Main Building.]

thread has been very plentifully used, but the metal is of so debased a quality that it has become almost black.

The use of tapestry for church decoration and household furniture in Europe was for a long period very great. Many large pieces, mostly of a scriptural character, were provided by Cardinal Wolsey for his palace at Hampton Court. In the next generation, a very famous set was made in Flanders, which for many years decorated the walls of the House of Lords, London; it represented the defeat of the Spanish Armada. This magnificent memorial was destroyed by fire in 1834. One fragment only is known to exist. This piece was cut

out to make way for a gallery at the time of the trial of Queen Caroline, and was secreted by a German servant of the Lord Chamberlain. The relic was bought some years after for £20 and presented to the corporation of Plymouth, who still possess it.

The most beautiful series now in the world is in the Vatican at Rome, and may be judged of by looking at a few of the original



"The Great Exhibition, 1876."]

PUNCH-BOWL.
Russian Court.

[The Main Building.

cartoons at present in the South Kensington Museum. Duke Cosimo tried to set up tapestry-work at Florence, but did not succeed. Later, Rome produced some good things; among others, the fine copy of Da Vinci's Last Supper, still hung up on Maunday Thursday. England made several attempts to re-introduce the manufacture: first at Mortlake, then afterwards in London, at Soho. Works from these two establishments may be met with. At Northumberland House there was a room hung with large pieces of

tapestry wrought at Soho, and for that mansion, in the year 1758. The designs were by Francesco Zuccherelli, and consisted of landscapes composed of hills crowned here and there with the standing ruins of temples or strewn with broken columns, among which groups of country folks are wandering and amusing themselves. Mortlake and Soho were failures. Not so the Gobelins at Paris, as every one well knows.

In many English houses, especially in the country, good samples of late Flemish tapestry may be found. Close to London, Holland House is adorned with some curious specimens, particularly in the



"The Great Exhibition, 1876."

RUSSIAN POTTERY.
Russian Court.

[The Main Building.

raised style. An earlier example of the fifteenth century, representing the marriage of Louis XII and Anne of Brittany, is in a foreign collection.

Imitated tapestry existed long ago under the name of "stayned cloth," and the workers of it were embodied into a London guild. At the beginning of the sixteenth century, Exeter Cathedral had several pieces of old painted or "stayned" cloth: "i front stayned cum crucifixo, Maria et Johanne, Petro et Paulo; viij panni linei stayned, etc." The great use at that time of such articles in household furniture may be witnessed in the will—1503—of Katherine, Lady Hastings, who bequeaths, besides several other such pieces, "an old hangin of counterfeit arres of Knollys, which now hangeth

in the hall and all such hangyings of old bawdekyn, or lynyen paynted as now hang in the chappell." We may also remember that Falstaff speaks of it as an illustration easily understood; he says that his troops are "as ragged as Lazarus in the painted cloth."

Carpets are akin to tapestry, and though the use of them may perhaps be not so ancient, yet is very old. Here, again, we must look to the people of Asia for the finest as well as the earliest examples of this textile. Medieval specimens are rare anywhere,



"The Great Exhibition, 1876."]

RUSSIAN POTTERY.

Russian Court.

[The Main Building.

and we are glad to remember two pieces of that period fortunately in the collection at South Kensington—No. 8649—of the fourteenth century, and No. 8357, of the sixteenth, both of Spanish make.

The chambers of royal palaces and the chancels of parish churches used to be strewn with rushes. When, however, they could afford it, the authorities of cathedrals, even in very early times, spread the sanctuary with carpets; and at last old tapestry came to be so employed, as now in Italy. Among such coverings for the floor

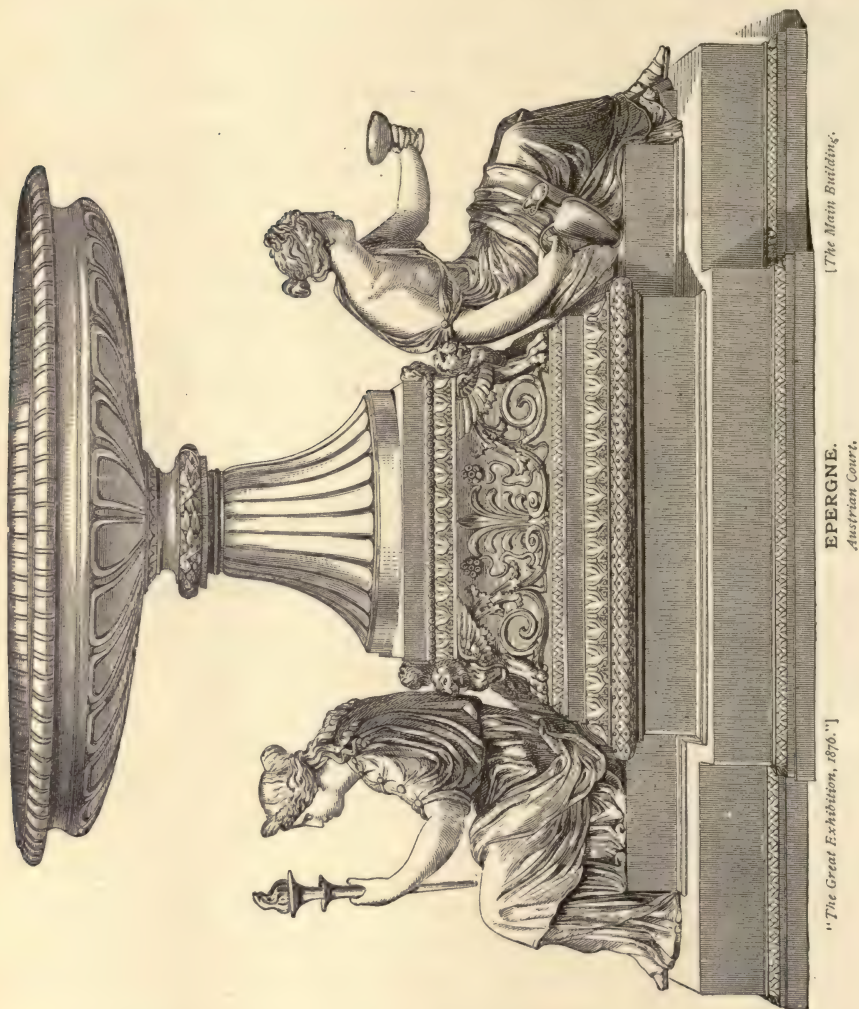
before the altar, Exeter had a large piece of Arras cloth figured with the life of the Duke of Burgundy, the gift of one of its bishops, Edmund Lacy, in 1420; besides two large carpets, one bestowed by Bishop Nevill in 1456, the other, of a checkered pattern, by Lady Elizabeth Courtney: "carpet et panni coram altari sternendi; i pannus de Arys de historia ducis Burgundie: i larga carpeta, etc." In an earlier inventory we find that among the "bancaria" or bench-coverings in the choir of the same cathedral, one was a large piece of English-made tapestry with a fretted pattern. From existing testimony, we believe that such must have been the practice at Croyland, where Abbot Egelric—the second of the name—gave to that church, before the year 992, "two large foot-cloths—so carpets were then called—woven with lions to be laid out before the high altar on great festivals, and two shorter ones trailed all over with flowers, for the feast days of the apostles." The quantity of carpeting in palaces may be seen by the way in which Leland tells us that "my lady the queen's rooms" were strewed with them "when she took her chamber."

The use of carpets and woollen hangings is coeval with civilization. They were among the first furniture of man. The pastoral tribes of the elevated plains of Asia employed furs and fleeces to protect them from the chilly exhalations of the night, and from the burning soil of the desert. When the shuttle was invented, a woven material was substituted, to which the loom gave its pattern and the dyer its varied colors.

In the time of Homer the fabrics of Babylon, Tyre and Sidon were celebrated, and Egypt, as well as India, early learned to excel in the art of weaving woollens. The taste of the two countries bears characters of great resemblance, and many of the patterns of ancient Egypt differ little from those of modern India. The Greeks sent to Media for carpets to cover their seats, and it is in Persia this industry was first developed. Time has not modified the manufacture. The vertical loom still used by the weaver of Lahore and Cashmere is identical with that employed perhaps four thousand years ago, and the frame that produced the carpets celebrated by

Homer and Virgil, is the same used for those of Turkey and Algiers.

The people of northern Europe were long without the use of



carpets—a cold, coarse matting replaced the warm woollen material; yet it appears the Gauls early learned the art, and, in the time of the Romans, the red fabrics of Arras had already attained a certain reputation. Who would have foretold that Gaul and Britain, then

scarcely within the pale of civilization, should in after ages be the seat of a flourishing industry which would rival the manufactures of the East?

As early as the tenth century there was a manufacture of tapestry in the Abbey of St. Florent, at Saumur, where the monks wove hangings decorated with flowers and animals; and a few years later a Count of Poitiers offers Robert, King of France, for his assistance in an expedition, a sum of money and a hundred pieces of the tapestry for which Poitiers was then celebrated, the Italian prelates sending there for its productions.

Tradition also assigns the establishment of the fabric at Aubusson to refugees of the great army of Abd-er-Rahman, routed by Charles Martel between Loudun and Tours, in 732. The retreat of the Emir of Spain was so rapid that many were left behind among the Gallo-Franks of Aquitaine. The weaving of carpets was the principal trade of these Saracens, who had invaded Europe by Spain, as they later entered by the Bosphorus.

Up to the eleventh century these woollen fabrics of Europe were made for the hangings of churches and palaces, though probably foot-carpet were also used in the royal habitations and to lay before the altar. The Crusades introduced, with other eastern productions, the carpets of Damascus, Alexandria and Cairo, yet straw and rushes were to a late period still generally used to spread over the apartments.

Italy made tapestry at Bergamo; but the introduction of paper hangings in the fifteenth century led to the decline of the manufacture. From the thirteenth century the productions of Flanders were renowned above those of all other countries. They were made at Oudenarde, Brussels, and, principally of all, at Arras—not then in France. So famous became this city that it gave its name to the production, tapestry being styled *Arazzo* in Italian, and “arras” in English; and, after the battle of Nicopolis, in 1396, the ransom paid to Bajazet for the liberation of a son of the Count of Flanders consisted of a sum of money and a series of Arras tapestries representing the life of Alexander the Great. Here, too, were executed

in later times the ten pieces sent by Francis I to Pope Leo X, worked



"The Great Exhibition, 1870."

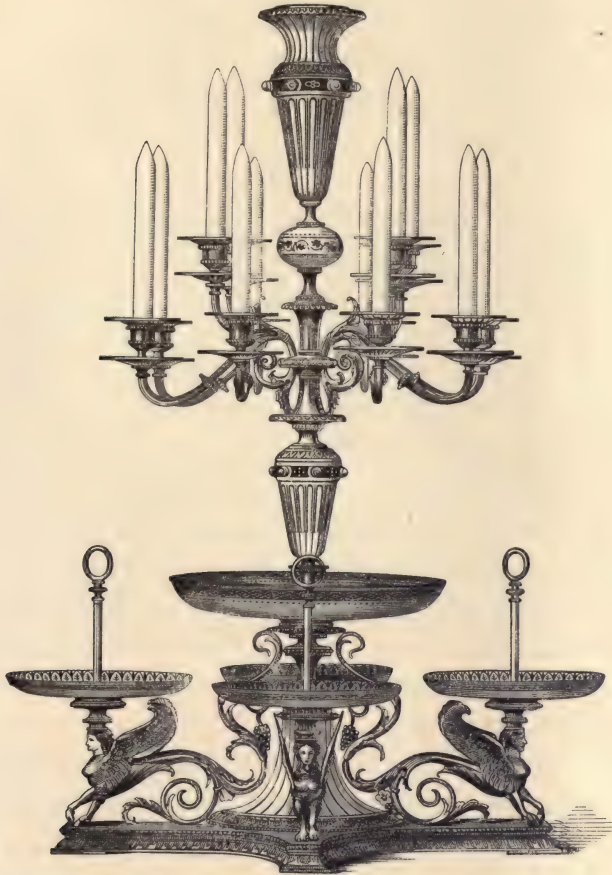
SERVICE OF GLASSWARE.
Austrian Court.

[The Main Building.

from the designs of Raffaelle, the original cartoons for which are

the choicest of art treasures. But the tapestries of Flanders have died away; the last piece was made at Brussels in 1781. France alone maintains the manufacture.

Until the sixteenth century all the tapestry made in France was due to private enterprise. It was Francis I who first made it a state



"The Great Exhibition, 1876." **EPERGNE AND CANDELABRA.**
Austrian Court.

(The Main Building.

manufacture. He collected the best workmen Flanders and Italy could produce and established them at Fontainebleau. Primaticcio furnished the designs. Henry II appointed Philibert Delorme director of the new manufacture, and set up another at Paris, in the Hôpital de la Trinité. The civil and religious wars of his sons were

fatal to royal establishments as well as to private industry, but Henry IV resumed the work of Francis I. He established a fabric of tapestry in the Faubourg St. Antoine, whence, after various transfers, the workmen were placed on the banks of the Bièvre, where Jean Gobelins the dyer had established himself in the fifteenth century, the waters of that river being famous for the dyeing of scarlet; but Jean Gobelins grew rich, his family became ennobled.

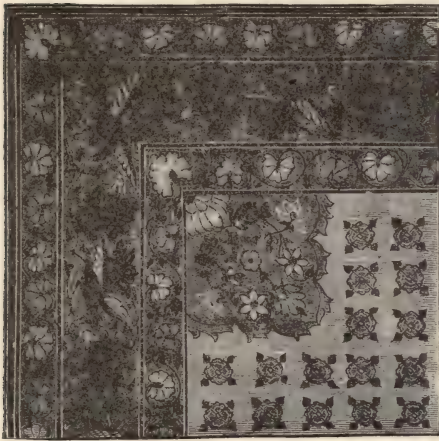
With Louis XIV and Colbert all the royal manufactures rose to a new existence. Under the name of "Royal Manufacture for the Furniture of the Crown," were united at the Gobelins, goldsmiths, engravers, lapidaries, furniture and tapestry-makers, dyers, etc.—all the workmen of various trades employed for the sovereign. Lebrun was appointed director, and the establishment of the Gobelins became a school for all the industries connected with furniture. Louis wished to set his people the example of model manufactures—not to crush private industry, but to stimulate and give a right direction to its labors. The harmony that pervaded at that epoch in every branch of decoration, shows the unity of spirit that inspired them all. The genius of Lebrun was universal. His heroic pieces were the subjects of the tapestries; even for the locks and bolts he furnished the models; from the ceiling to the floor all was designed under his eye. The first artists lent their assistance in carrying out his conceptions. Van der Meulen painted pieces with horses and battles, Monnoyer with flowers, and Boulle executed the furniture designed by Lebrun.

The same activity reigned at the Savonnerie, a royal manufacture of carpets founded at Chaillot, in an old soap manufactory, whence it derived its name. While the Gobelins covered the walls, the Savonnerie decorated the floors. Those of the long gallery of the Louvre and Salle d'Apollon were among its products. The first was begun in the reign of Henry IV. It comprised ninety-two compartments, each ten yards long by five or six yards wide—doubtless the largest foot-carpet ever made. In 1825, the manufacture of the Savonnerie was united to that of the Gobelins.

Two years after the establishment of the Gobelins, Colbert

opened a manufacture of tapestry at Beauvais, which had Oudry and Boucher among its directors. It is now united to the Gobelins.

The Gobelin establishment is divided into three branches, one for dyeing, the other two for making tapestry and carpets. The dyeing is considered the first in the world; the waters of the Seine are substituted for those of the Bièvre, now degenerated into a dirty stream. The colors are more lasting, each combination of color has twenty different shades, the gradations being so insensible as only to be distinguished by a practised eye. They are all classed by M. Chevreul in his chromatic scale which gives to each shade—in all 14,420—its



"The Great Exhibition, 1876."



The Main Building.

CARPETS.
German Court.

special number, by which it may be described. His chromatic circle is, at the Gobelins, formed of skeins of silk.

The Gobelin tapestry is made on the upright frame—*haut lisse*—the artist is placed behind, his back to the model.

In the carpet manufacture, the upright frame is also used, but the workman sits in front of his work. The threads of wool which form the velvet pile are secured to the cotton or hemp warp by a double knot. This gives them the greatest solidity. Friction and wear only add to their durability, as they have the effect of drawing closer the knots which fasten the wool to the warp. The wool is carefully cut and shorn, until the pile reaches an inch in thickness. The

Savonnerie carpets are perhaps the largest made, generally white, with arabesque borders, of surpassing excellence, from the fine quality of the wool, the delicacy of the dyes, the richness and harmony of the colors and the precision and skilfulness of their workmanship.

In the Beauvais tapestries, we especially admired a pink *écran*, or fire-screen, a group of chairs, the ground of the medallions a soft cream color, with charming bouquets of life-like anemones and tulips. In addition is a hunting subject. It is impossible to realize the delicacy and finish of these compositions, whether as regards the harmonious beauty of their coloring, the artistic value of their grouping, or the delicate blending of the lights and shadows.

Similar in workmanship to the tapestry of the Gobelins and the carpets of the Savonnerie, are the fabrics of Aubusson, in the department of the Creuze, part of the ancient province of La Marche. We have already alluded to their supposed origin from a colony of Saracens, in the eighth century. Until 1740, the manufacturer made only the Gobelin tapestry, fine, when used for the hangings of walls, and coarser, when destined for the smooth carpet, or *tapis raz*. Since then, the long woollen high-piled carpets of the Savonnerie have been imitated. The productions of Aubusson are highly artistic; the finest wools of the best dyes are employed. Established for so many centuries, the special traditions of the art and the aptitude for execution, like those of glass-making, become hereditary in families. No other place can produce such a staff of workmen as Aubusson, and even there it takes fifteen years to qualify for the work the apprentice who has been accustomed, almost from infancy, to handle his father's frame. Tapestry is produced here at a much cheaper rate than in the Imperial fabric. While a work of tapestry will cost at the Gobelins from \$600 to \$750 the square metre, at Aubusson it rarely exceeds \$100. The great expense is in the fabrication; the material only enters for twenty per cent. in the value. In a *portière* costing \$200, \$160 goes to the workman.

Germany, which owes the development of her carpet industry to French enterprise and design, shows great advancement over her displays at previous exhibitions; the two specimens which we



"The Great Exhibition, 1876."

ALBUM COVER.
German Court.

[The Main Building.

engrave on page 247 are choice examples of Berlin and Elberfeld factories. They show elegance in design and good blending of colors, but were hung so much out of peoples' way that they failed to attract much attention.

In the rear of the Carpets was the collective exhibit of the German publishers, and a little west of this were the Austrian and German exhibits of Albums and Bindings. From these exhibits we engrave an Album Cover, on page 249, which is symbolical in its design of Art and Industry.

A few good examples of German work in silver were exhibited in the court immediately adjacent to the main avenue; in the same collection a small assortment of jewelry was also exhibited. The dish or plateau engraved on the next page, and the casket, with its top, on page 253, are from the exhibit of Mr. Zimmerman, of Hanau, and Erhard & Sons. The plateau is a fine and elaborate piece of work of a class too highly finished and too costly for the ordinary uses to which plates are put, but it is designed to serve a purely artistic end by being suspended from the wall or given a place on a mantel or in a cabinet.

This custom of using artistic plaques and plateaux for decorative purposes is extremely popular just at the present time; and as the fashion is a good one and founded upon thoroughly artistic principles, it is likely to continue.

No one who has not tried the experiment himself or seen it tried by others can realize the excellent effect of hanging some brightly-colored dish or plate such as this upon the wall in the same manner as a picture. It lights up a room wonderfully, and when several of them are so disposed, with pictures and engravings at irregular intervals, the *tout-ensemble* is capital.

Messrs. Erhard & Sons' Casket is about nine inches long, six inches wide and six inches high. It is ornamented with scroll designs in *repoussé*-work upon the front and back, and the two side panels contain portrait-medallions between branches of laurel, done in the same manner. The angles at the junction of the sides are concealed by curved projections terminating in scrolls at the feet.

The lid or cover to the article is somewhat more elaborately ornamented by the same *repoussé* process. On the four sloping sides are baskets of a classical shape containing fruit and flowers. On either



"The Great Exhibition, 1876."

SILVER PLAQUE.

[The Main Building,

By Zimmerman, of Hanau.

side of these are sprays of leaves woven together in a simple, graceful pattern. In the upper panel is a square, raised frame, within which is an oval containing a group of a cupid and a nymph, the latter playing upon a flute. Beside the cupid is a harp, and in the distance

are sheep and a pastoral landscape. The artist has taken rare pains with this part of his work, and has produced a very effective and pleasing bas-relief. As no gilding or enameling is used in decorating this casket, the claim for attention which it has is solely its artistic workmanship in this particular branch of the silversmiths' trade. As *repoussé*-work is now so fashionable that nearly all the large manufacturers of plate in Europe and this country are producing it, our readers will be interested in contrasting the work of the various nations which we illustrate. In this way those who are directly interested in the process will gain valuable ideas, and those who simply take an interest in industrial art products generally, will be able to form an intelligent idea of whatever characteristics are distinctly national.

The works in silver which we engrave on pages 254 and 255 are from the exhibit of Ritter & Co.; and the artistic gold-work on pages 256 and 257 are from the workshops of Messrs. Gerstle & Hartung.

The history of pottery and its manufacture is a subject of great extent; because from a very early period of human existence, known to us only by the tangible memorials of primitive inhabitants, the potter's art appears to have been practised. At first the vessels were of coarse clay, rude and sun-dried or ill-baked, and occasionally ornamented with concentric and transverse scratches; from which state they gradually developed to the exquisite forms and decoration of the Greek pottery; but it would seem that however universal the production of vessels of baked clay, the art of applying to them a vitreous covering or glaze was an invention which emanated from the east, from India or Egypt, Assyria or Babylon.

On this point Dr. Birch, in the introduction to his erudite work on ancient pottery, says: "The desire of rendering terra cotta less porous and of producing vessels capable of retaining liquids, gave rise to the covering of it with a vitreous enamel or glaze. The invention of glass has hitherto been generally attributed to the Phœnicians; but opaque glasses or enamels as old as the eighteenth dynasty, and enameled objects as early as the fourth, have been found

in Egypt. The employment of copper to produce a brilliant blue-colored enamel was very early, both in Babylonia and Assyria; but



"The Great Exhibition, 1876."]

CASKET.

By Erhard & Sons.

[The Main Building.

the use of tin for a white enamel, as recently discovered in the enameled bricks and vases of Babylonia and Assyria, anticipated, by

many centuries, the re-discovery of that process in Europe in the fifteenth century, and shows the early application of metallic oxides. This invention apparently remained for many centuries a secret among the eastern nations only, enameled terra cotta and glass forming articles of commercial export from Egypt and Phœnicia to every part of the Mediterranean. Among the Egyptians and Assyrians enameling was used more frequently than glazing, and their works are consequently a kind of faience, consisting of a loose frit or body, to which an enamel adheres, after only



CASKET.
By Ritter & Co.

a slight fusion. After the fall of the Roman Empire, the art of enameling terra cotta disappeared among the Arab and Moorish races, who had retained a traditional knowledge of the process. The application of a transparent vitreous coating or glaze over the entire surface, like the varnish of a picture, is also referable to a high antiquity, and was universally adopted, either to enhance the beauty of single colors or to promote the combination of

many. Innumerable fragments and remains of glazed vases, fabricated by the Greeks and Romans, not only prove the early use of

glazing, but also exhibit in the present day many of the noblest efforts of the potter's art."



[The Main Building.]

SILVER.
By Ritter & Co.

"The Great Exhibition, 1876."

It is true that on the Greek, Etruscan and Roman pottery a subdued and hardly apparent glazing was applied to the surface of the

pieces, but it is so slight as to leave a barely appreciable effect upon



"The Great Exhibition, 1876."

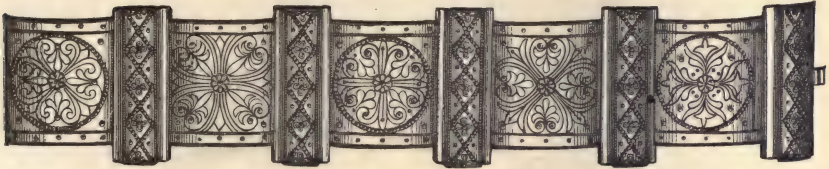
JEWELRY.
German Collective Exhibit.

[The Main Building.

the eye, beyond that which might be produced by a mechanical

polish, and so thinly laid on as almost to defy attempts at proving its nature by chemical investigation; it is, however, supposed to have been produced by a dilute aluminous soda-glass, without any trace of lead in its composition, the greater portion of which was absorbed into the substance of the piece, thereby increasing its hardness and leaving only a faint polish on the surface of the ware.

In Egypt and the east the use of a distinct glaze—*invetriatura* of the Italians—covering the otherwise more porous substance of the vessel, appears to have been known and to have arrived at great perfection at a very remote period. It was, in fact, a superior ware,



"The Great Exhibition, 1876."

JEWELRY.
German Collective Exhibit.

[The Main Building.

equivalent to the porcelain of our days, and from the technical excellence of some of the smaller pieces has been frequently, but wrongly, so called.

It will perhaps be as well, before entering further into the consideration of the subject, to define and arrange the objects of our attention under general heads.

Pottery—*Faience*, *Terraglia*—as distinct from porcelain, is formed of potter's clay mixed with marl of argillaceous and calcareous nature and sand, variously proportioned, and may be classed under two divisions: Soft—*Faience à pâte tendre*—and Hard—*Faience à pâte dure*—according to the nature of the composition or the degree

of heat under which it has been fired in the kiln. What is known generally as earthenware is soft, while stoneware, queensware, etc. are hard. The characteristics of the soft wares are a paste, or body, which may be scratched with a knife or file, and fusibility, generally, at the heat of a porcelain furnace.

These soft wares may be again divided



into four subdivisions: unglazed, lustrous, glazed and enameled. Among the three first of these subdivisions may be arranged almost all the ancient pottery of Egypt, Greece, Etruria and Rome; as also the larger portion of that



"The Great Exhibition, 1876."]

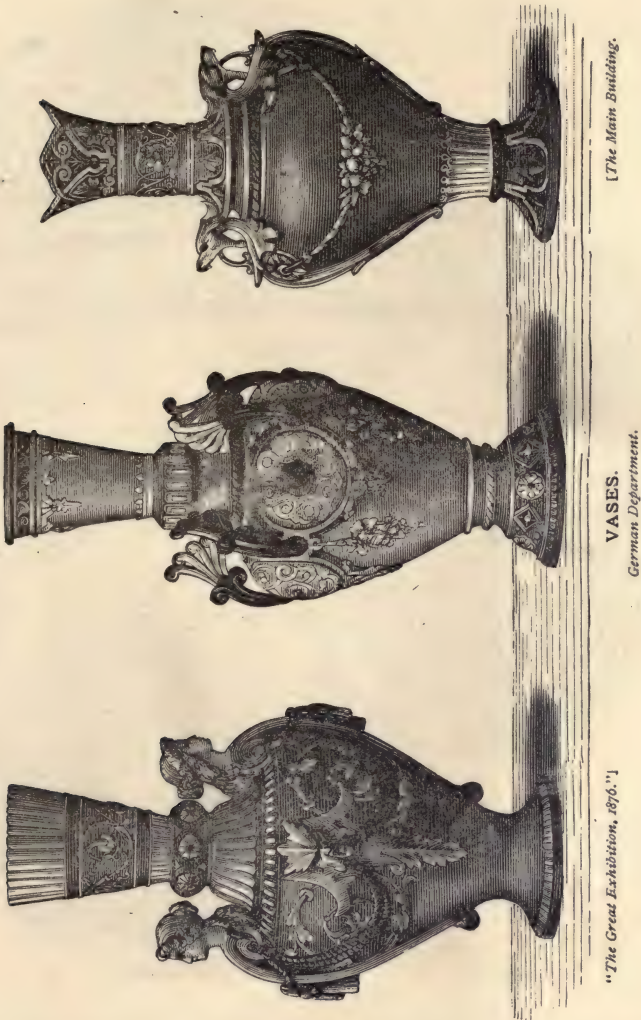


[The Main Building.

GERMAN STEINGUT.

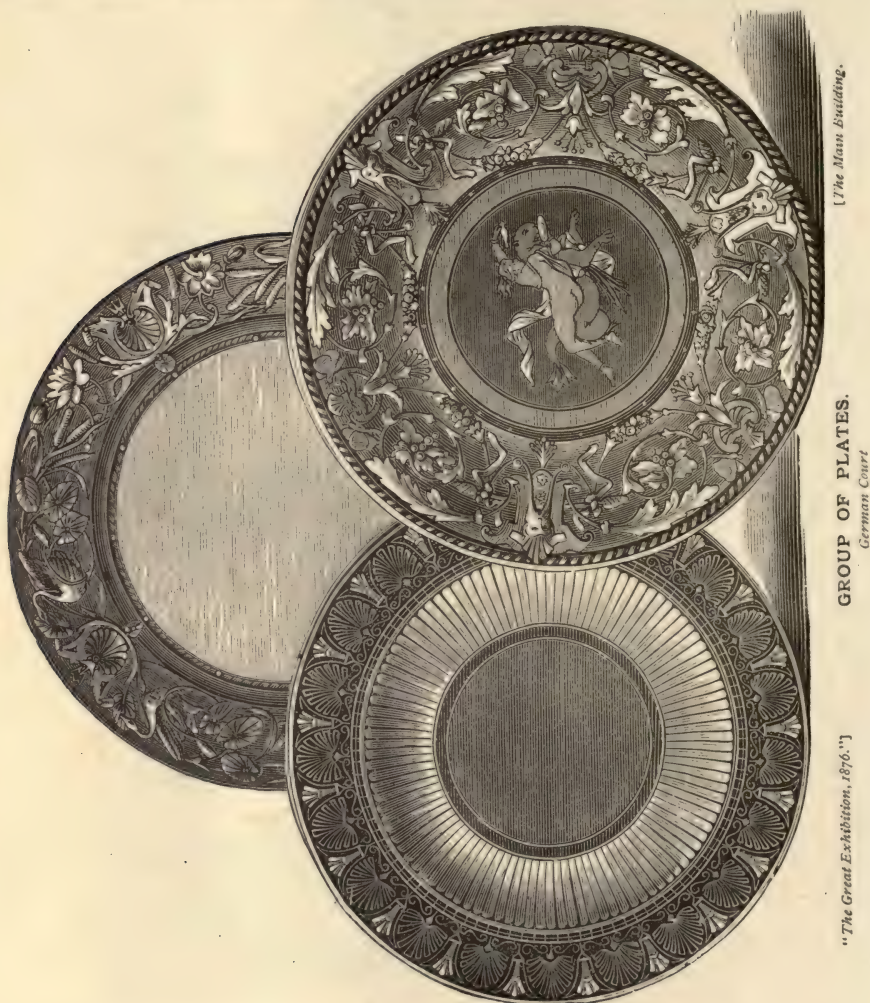
in general use among all nations during medieval and modern times. We shall be occupied with the glazed and enameled wares; the first of which may be again divided into siliceous or glass glazed and plumbeous or lead glazed.

In these subdivisions the foundation is in all cases the same. The mixed clay or "paste" or "body"—varied in composition according to the nature of the glaze to be superimposed—is formed by the



hand, or on the wheel, or impressed into moulds; then slowly dried and baked in a furnace or stove, after which, on cooling, it is in a state to receive the glaze. This is prepared by fusing sand or other siliceous material with potash or soda to form a translucent glass,

the composition, in the main, of the glaze upon siliceous wares. The addition of a varying but considerable quantity of the oxide of lead, by which it is rendered more easily fusible but still translucent,



constitutes the glaze of plumbeous wares; and the further addition of the oxide of tin produces an enamel of an opaque white of great purity, which is the characteristic glazing of stanniferous or tin-glazed wares. In every case the vitreous substance is reduced to the finest powder by mechanical and other means, being milled with

water to the consistency of cream; into this the dry and absorbent baked piece is dipped and withdrawn, leaving a coating of the material of the bath adhering to its surface. A second firing, when quite dry, fuses this coating into a glazed surface on the piece, rendering it lustrous and impermeable to liquids. The two former of these glazes may be variously colored by the admixture of metallic oxides, as copper for green, iron for yellow, etc.; but they are nevertheless translucent and show the natural color of the baked clay beneath.

The vitreous, silico-alkaline or glass-glazed wares were of very ancient date and in all probability had their origin in the East, in Egypt, or India, or Phœnicia; indeed, the discovery of glass—which has always been attributed to the latter country—would soon direct the potter's attention to a mode of covering his porous vessel of baked earth with a coating of the new material; but the ordinary baked clay would not take or hold the glaze, which rose in bubbles and scaled off, refusing to adhere to the surface, and it became necessary to form the pieces of a mixed material, consisting of much siliceous sand, some aluminous earth and probably a small portion of alkali, thus rendering it of a nature approximating to that of the glaze and to which the latter firmly adhered. In some instances, on the finer examples which may probably have been exposed to a higher temperature in the oven, the glaze and the body of the piece have become so incorporated as to produce a semi-translucent substance, analogous to some artificial porcelains. In its nature this glaze is translucent and, accordingly, we find that when ornamented with designs they are executed directly on the "biscuit," or unglazed surface of the piece, which then receives its vitreous covering through which they are apparent. By means of an oxide of copper the exquisite turquoise-blue of ancient Egypt, "scarcely rivaled after thirty centuries of human experience," was produced. The green color was, perhaps, given by means of another oxide of the same metal; violet by manganese or gold, yellow by silver or perhaps by iron, and the rarer red perhaps by the protoxide of copper. We also find that bricks and vases of similar glazing, brought

to its greatest perfection in Egypt, were made by the Babylonians and Assyrians.

Throughout Babylonia the sites of ancient buildings afford fragments of glazed pottery. The glaze of those brought from Borsippa by the Abbe Beauchamp, in 1790, was analyzed and found to contain neither the oxides of lead nor tin, but to be an alkaline silicate with alumina, colored by metallic oxides. A more recent analysis of Assyrian examples shows that, with a base of silicate of soda or soda-glass and oxide of tin the opaque-white has been produced, being the earliest recorded example of "enameled" ware. A small



"The Great Exhibition, 1876."

JARDINIÈRE.

[The Main Building.

The Royal Porcelain Works of Berlin.]

quantity of oxide of lead was also found in the blue glaze on tiles from Babylonia. At Warka—probably the ancient Ur of the Chaldees—there were discovered numerous coffins or sarcophagi, piled one upon another to the height of forty-five feet, of peculiar form and made of terra cotta glazed with a siliceous glaze of bluish-green color. They are formed somewhat like a shoe, an opening being left at the upper and wider end for the insertion of the body, and closed by an oval lid which, as well as the upper part of the coffin, is ornamented with figures and plants in relief. They are supposed to be of the Sassanian period.

The metallic lustre in decoration was applied, apparently at an early time, to pottery glazed with a siliceous coating and appears to

have established itself in Persia. On specimens from Arabia it is also found and its use in combination with this glaze may possibly have preceded the manufacture of lusted wares coated with the stanniferous enamel by the eastern potters of the Balearic Islands, Spain and Sicily.

In Northern India, at Sind and in Persia, wares are made at the present day of precisely the same character as the ancient pottery under consideration. Pieces from the former locality, which were exhibited at the International Exhibition of 1873, are composed of a sandy, argillaceous frit, ornamented with pattern in cobalt blue beneath a siliceous glaze, similar to those specimens which we engrave on pages 258, 259 and 260, from the exhibits of Villeroy & Co. and Merklebach. Indeed, their agreement in technical character with some of the pottery of the ancient Egyptians and Assyrians, and with that produced in Syria and Persia during the fourteenth, fifteenth and sixteenth centuries is most remarkable. Persia also now produces inferior wares of the same class.

We thus see how widely spread, and at how early a period, the use of this most ancient mode of glazing was established and brought to perfection. It was the parent of all those wares now known as Persian, Damascus, Rhodian, or Lindus.

From the truly regal display of porcelain made by the Royal Porcelain Works at Berlin, we select for illustration, on page 262, a masterpiece in its way. It is a large oval vessel intended to be used as a Wine-Cooler, or if desired it can be used, as it is at the present time, for a Jardinière. In either use it makes a very striking and beautiful object; but the design and style of ornamentation make the former purpose preferable. The material, though porcelain, is treated so as to resemble Italian majolica, and none but an expert could pronounce upon its genuineness. The design is masterly and the execution faultless. Nothing could be more spirited than the lines of the Triton's head, the modeling of the mermaids who clasp hands above his waving locks, and the graceful curves of their attitude. The handles on either side are ornamented with masks and scroll-works suggesting shells, and a simple border above and below serves

to give finish to the rim and base. There is an entire absence of anything like "finnikiness" about the ornamentation of the piece that makes it appear peculiarly massive and noble. Every part of the design is drawn with a strong, bold hand, suggestive of the best period of this style of work.

Crossing the central transept, we re-enter the exhibit of the



"The Great Exhibition, 1876.")

SILVER PITCHER.

[The Main Building.

By Gorham Manufacturing Company.

Gorham Manufacturing Company, from which we engrave—above—a mug in silver, with one of Mr. Pairpont's exquisite designs worked in *repoussé*, and a vase, on the next page, of Greek design, with Night in relief on a stipple background. The stall next to the Gorham Company's is occupied by Messrs. Tiffany & Co., of New York, from whose exhibit we engrave the best in their stall—the "Comanche Cup"—which will be found on page 266. The main figure represents

a Comanche hunter armed with a rifle, clinging dexterously to a galloping mustang in such a way as to shield his body and retain the use of his arms for defence or attack. The bas-relief on the pedestal is a fine specimen of *repoussé* chasing. Including the base, it is wrought wholly of sterling silver.

The stall adjoining Messrs. Tiffany's is occupied by Messrs. Starr & Marcus, of New York, from whose exhibit we have selected as the subject for engraving on page 267, the Diamond Necklace and Pendant which occupy the place of honor in their principal case. Our illustration conveys, as well as it is possible for the graver's art to do it, an



GREEK VASE, IN SILVER.
By Gorham Manufacturing Co.

idea of the brilliancy of these superb articles; but whoever is privileged to see the originals will realize how impossible it is to give in black and white much more idea of the gems themselves than their size and shape. Their commercial value we believe is very

great; but their value to connoisseurs who recognize the purity of the stones, the evenness of their cutting, and the exactness of size, shape and brilliancy in the pairs, hardly any estimate can be placed upon their worth.

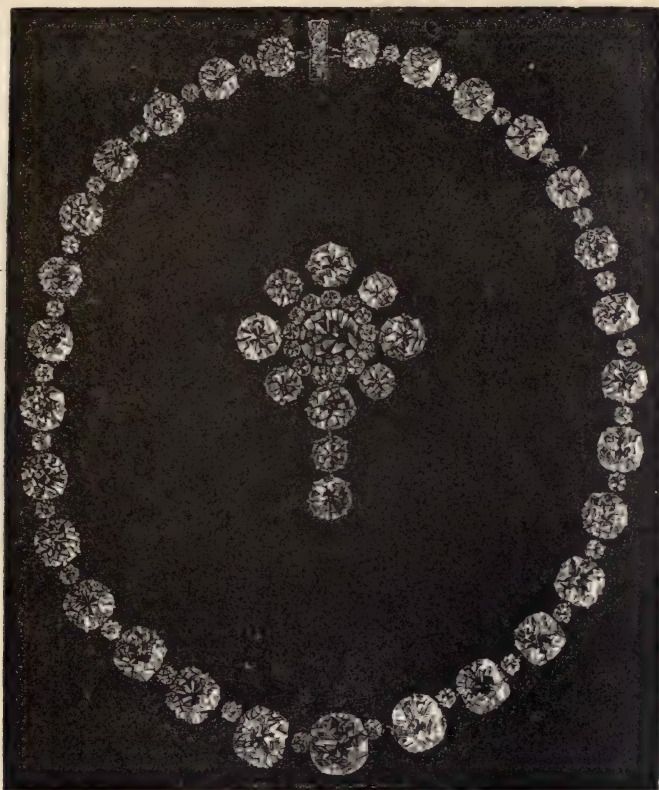
We wonder how many of our readers know what a natural diamond really looks like. All are, of course, familiar with the gem as it is offered for sale in the dealer's window, but few would recognize in the insignificant lump, looking more like a morsel of clay

than anything else, the origin of the sparkling brilliant which is the first and most precious of all the products of the globe. We need not enter into the discussion of what the diamond really is. Whether



it is vegetable or mineral, whether it is pure carbon or a vegetable substance slowly pressed into a crystalline form, is yet to be determined by science. But some notion of the manner in which the

natural stone is afterwards treated may be of interest. The workmen of Amsterdam, as everybody knows, have almost a monopoly of the trade of diamond-cutting. Standing before a swiftly-revolving steel disc, called a "skaif," lubricated with oil, the diamond-cutter presses the diamond, soldered into a brass holder, against the steel, and



DIAMOND NECKLACE AND PENDANT.

By Starr & Marcus.

grinds down one of the faces or facets. The shape into which the diamond is to be cut has been determined beforehand, but it is often necessary to change the original design as the work progresses, owing to flaws or imperfections in the stone. After one face is ground, the stone is taken from the solder, cemented so as to present another surface, and so the work progresses. It is easy to conceive how delicate must be the manipulation to produce the exact angles

for the highest refraction of light in a stone which is cut into, say, fifty-eight facets. A slight slip may damage a gem to the extent of hundreds of dollars. It is not generally known, yet it is well for those who possess diamonds to know, that it is a dangerous experiment to emulate the example of Francis the First of France, and



"The Great Exhibition, 1876."

NECKLACE.
By Morgan & Headley.

[The Main Building.

attempt to scratch with them upon glass. The glazier's diamond always presents a *natural* angle as the cutting edge; but as the gem has artificial angles, it may be that one of these may be used by the amateur, and owing to the peculiar crystalline structure of the diamond he will be dismayed to find that he has split off a portion of the stone and ruined its beauty and symmetry for ever.

Continuing in the region of the American silverware and jewelry,

the former especially being a noble exhibit, we turn now to the latter branch of manufacture which is but a civilized expression of a desire inherent to human nature—the love for personal adornment. It is the same in the savage of the wilderness as in the citizen of Paris. The Indian woman smearing her face with colored clays, the negro hanging her string of shells about her neck, the lady at her toilette fastening jewels in her ears or clasping a bracelet upon her arm, each and all are actuated by the same desire to beautify themselves. The art of the goldsmith and jeweler owes its perfection to this feeling.



"The Great Exhibition, 1876."]



CAMEOS.
Morgan & Headley.



[The Main Building.

On pages 268, 269 and 270 our engravings illustrate specimens of this work from the establishment of Messrs. Morgan & Headley, of Philadelphia. Looking at these objects from a utilitarian standpoint, what could be more useless than they? How senseless it seems to weight one's body down with metal trinkets! Fortunately, however, the refinements of civilization find other expression than in requiring all objects to be useful.

We are now considering its other great want—the ornamental. Here are several pieces, each one of which helps to supply this want. Of the lockets, all gain increased beauty from another art, of which we may speak at some other time—the art of the cameo-cutter or lapidary. Each of the designs is different, some suggesting the

study of antique models, others the artists' own design. The cross is of a different pattern from any of the other specimens. It is made in two different colors of gold, the points of the lighter-colored metal. This is a favorite style of workmanship at present, and is capable of excellent effects. The other specimens, as far as the goldsmith's work is concerned, is but the setting of a dozen gems. In the centre of the pin is a large amethyst surrounded by a narrow rim of gold, about which again is a string of small pearls. The whole effect is very neat and pretty.



"The Great Exhibition, 1876."

JEWELRY.
Morgan & Headley.

[The Main Building.

From the Meriden Britannia Company, of West Meriden, Connecticut, we have a group—engraved on the next page—in the fine white metal, heavily silver-plated, which is their specialty, representing a scene such as cannot be witnessed outside of America. The artist, whom we feel safe in pronouncing an American, has desired to illustrate something exclusively our own. With this intent, he could hardly have chosen anything more fully answering his desire than the characteristic group shown in our engraving. It is a Buffalo Hunt, not as practised in our day, when the poor brutes are slaughtered by hundreds, for mere sport, by bands of white hunts-

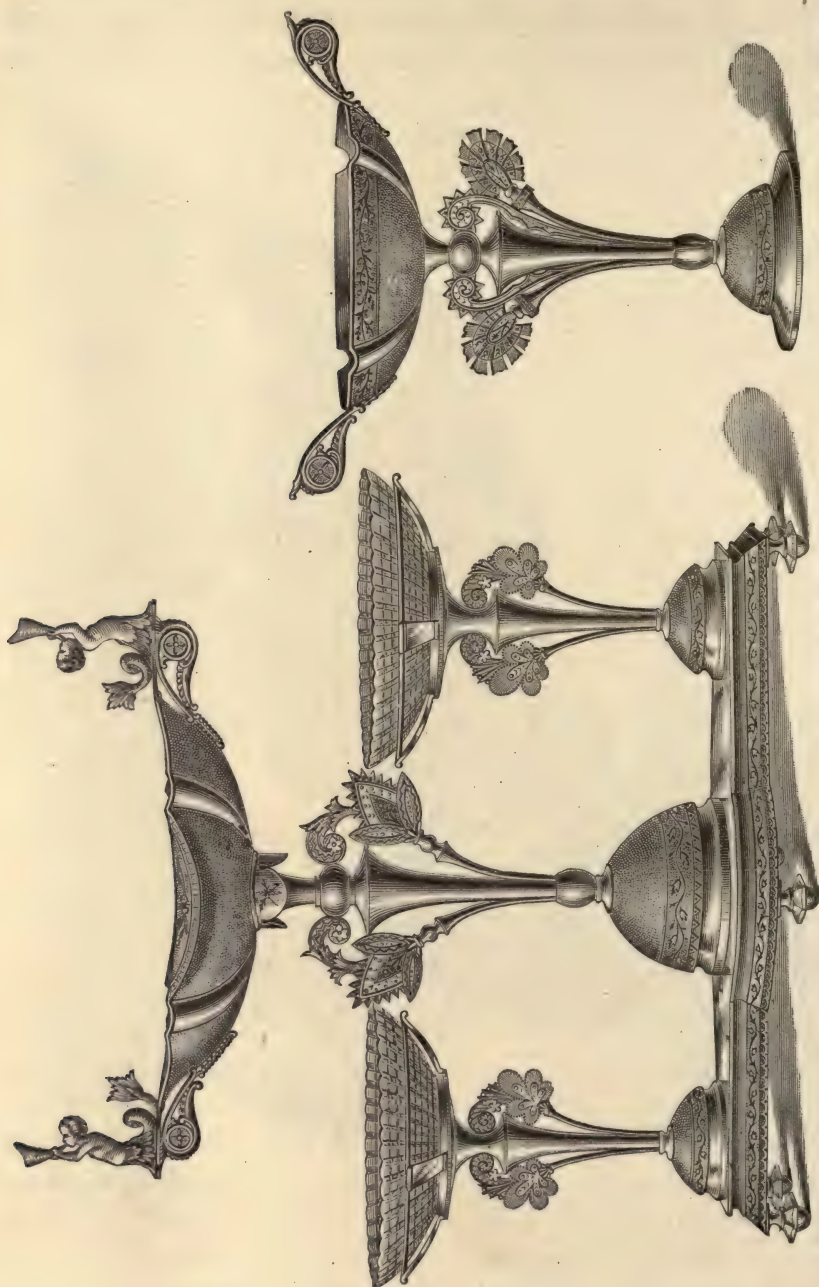
men armed with repeating rifles, but as in the days of old, before the crack of a firearm was heard, when the Indian of the plains hunted



BUFFALO HUNT.
By Meriden Britannia Company.

"The Great Exhibition, 1876."

his game with the spear and bow. There is an equality in such a contest as this as makes the group one of thrilling interest. The



SERVICE IN SILVER.

By Meriden Britannia Company.

"The Great Exhibition, 1876."

[The Main Building.]

supreme moment of the battle has been chosen. The infuriated bull,



"The Great Exhibition, 1876."

SILVER SWING-PITCHER.

By Middletown Plate Company.

[The Main Building.

wounded by an arrow, has turned and is charging the hunter; the

Indian, firmly bracing himself upon his unbridled steed, whom he guides by the pressure of the knees, is waiting, with uplifted spear, the onset. The horse, terrified, yet under too good control to fly, snorts and paws the ground. Action is expressed in every muscle of each figure in the group; and one cannot but feel, after looking at it for a moment, a certain sensation of expectancy, a wish that the *dénouement* could be acted out, which are sensations attesting the



"The Great Exhibition, 1876."

PROGRESS CUP.

By Reed & Barton.

[The Main Building.

realistic power of the artist. The group stands twenty-one inches in height upon a base twenty-seven inches long. It has been carefully and skilfully finished and would form a fine centre-piece for a buffet or a mantel-shelf. We also engrave, on page 272, portion of a silver service exhibited by the Meriden Britannia Company. From the exhibit of the Middletown Plate Company we engrave on page 273 a silver Swing-Pitcher of most beautiful design carefully manipulated.

It is quite fitting and natural that at the present time, when we are celebrating our Centennial, that our manufacturers, in producing

simply ornamental figures, should desire to typify, by every means in their power, the eventful hundred years of the nation's history. The theme is a grand one, capable of being treated in a thousand different ways and viewed from a thousand different standpoints; and, therefore, the number of groups which are to be seen in the Exposition illustrative of this subject is, perhaps, larger than of any other sub-



"The Great Exhibition, 1876."] **EPERGNE.—SILVER AND GLASS.**

By Reed & Barton.

[The Main Building.

ject. Among these manufacturers are Reed & Barton, of Taunton, Massachusetts, who send a large group, symbolic of Progress,—engraved on page 274—which was designed by W. C. Beattie. Its length is five feet, and its height four and a half feet. The progress of America from savage to civilized life is represented by a contrast between its condition in the fifteenth and the nineteenth centuries. On the left hand we have a group representing the primitive state of

the country: the party of savage Aztecs thinking of nothing but war—even the mother teaching her tender offspring the use of the



"The Great Exhibition, 1876."

URN.—REPOUSSE SILVER.

[The Main Building.

By Reed & Barton.

bow; the barren rocks and scattered bones indicating the lack of all notion of profiting by the fruitfulness of the soil, while the angry serpent may be looked upon as typifying the fight with untamed nature.

Four centuries pass, and behold the contrast! The Genius of



POT, PITCHER AND BOWL.—REPOUSSE SILVER.

By Reed & Barton.

Columbia, bearing the olive-branch of peace in one hand, and the



COMMUNION SERVICE.—REPOUSSE SILVER-WORK.

By Reed & Barton.

fascies of just government in the other, passes before us. Mercury, the swift-footed god of commerce and oratory, leads her steed by a flowery bridle, and thus symbolizes the guiding influences of his arts which have led us to prosperity. Beside Columbia walks Plenty, with her overflowing cornucopia; while beneath their feet spring the plants and fruits which indicate the prosperous results of agriculture. A student-group in advance, surrounded by the implements of science and studying problems which will still further advance our interests,



"The Great Exhibition, 1876." TORTOISE-SHELL NECKLACE.

By J. S. Adams, & Co., Providence.

[The Main Building.

indicates that the future holds in store for us other knowledge and that to the progress already made more is to be added. A bas-relief upon the pedestal represents the landing of Columbus, and above rises the vase with the dove and olive-leaf, typical of the peaceful period during which the arts have flourished. Surmounting the whole is the figure of Liberty, standing upon a broken chain, bearing in one hand the palm of victory, while with the other she holds the scroll on which is inscribed the record of our progress. She is the inspiring genius to whose benign influence we owe our prosperity.



"The Great Exhibition, 1876."

CLOCK.
By Mitchell, Vance & Co.

[The Main Building.]

The same firm also exhibit the Épergne and the table dishes in *repoussé* silver, which we engrave on pages 275, 276, 277 and 278.

Tortoise-shell is a material so beautiful in itself, and in some respects so easily worked that, in spite of its fragile nature and the loss which manufacturers undergo from breakage in the process of working, it has been found so profitable as to insure for it a permanent place in our jewelry shops. The play of light upon such a necklace as that represented on the page 279, from the establishment of Messrs. J. S. Adams & Co., Providence, Rhode Island, is really enchanting. The eye loses itself in the soft depths of the shell. The pattern is simple, but very pretty, and the pendant shows to great perfection the beauty of the material. As jewelry for the morning, to wear against a simple house-dress or a walking-suit, there is nothing so serviceable. It is easy to put on, beautiful to see, contrasts well with dress of any color, and is comparatively inexpensive. An artistic design is nowhere more exquisitely effective than in tortoise-shell.

Industrial Art does not fully achieve its end unless all articles of domestic use are redeemed from the hopeless ugliness into which they have fallen, so that our eyes shall be pleased and not pained by the surroundings of our daily life. It is noteworthy that most of this ugliness is produced by the desire to decorate, which, in the work of men destitute of artistic taste, results in meaningless and disagreeable perversion. There is a certain beauty in fitness, and a coal-scuttle or a kitchen-pail which is evidently constructed so as best to fulfil its purpose is fully justified. If, in addition, the lines of structure can be made pleasing to the eye, so much the better; but the first requisite is that the thing shall do honest work. But a curved or twisted or bedizened piece of furniture, whose shape or ornament interferes with its function, is hateful to gods and men. Then, too, we must recognize that some pieces of furniture, such as cabinets or sideboards, lend themselves naturally to a beautiful construction, while others, such as clocks, gas-fixtures, and especially chandeliers, offer much greater difficulty. With the latter, the problem is to suspend a large and heavy mass in the air and yet to

overcome, by the grace of its outlines and the beauty of its ornament, the reluctance of the eye to see the law of gravitation apparently violated. This difficulty proves too great for most designers, and frequently, in attempting to elaborate and ornament their work, they



"The Great Exhibition, 1876."

DIANA CLOCK.
By Mitchell, Vance & Co.

[The Main Building.]

fall into more positive ugliness. Really graceful designs, therefore, for interior metal-work deserve high praise. Such designs are shown in the articles of Messrs. Mitchell, Vance & Co., of New York, on pages 280, 282, 283, 285, 286 and 287. Their designs have achieved decided

success in the present cases. The ornamentations are elaborate but not overloaded, and the whole have an appearance of lightness and elegance. There would be no difficulty in filling a volume with illustrations of Messrs. Mitchell Vance & Co.'s exhibit, but we have



"The Great Exhibition, 1876."

ART.

By Mitchell, Vance & Co.

[The Main Building.

already afforded too much space—and cheerfully—to such a noble display. Prominent in their pavilion stood the bronze bust of a woman who lived, if she lived at all, in a time when men would have scorned the thought that any of her sex could minister to their intellectual pleasure. Her whole duty in life was to make herself beau-

tiful—to present herself before her lord decked out in all the bravery of barbaric ornament. How elaborate this was can be estimated from the elaborateness of the head-dress which we saw here. Yet, no one could look upon the perfect contour of her face, the firm lips, the noble brow and calm, steadfast gaze of the eye, without believing that here at least was a woman intellectually man's equal. The visitor would not fail to observe the bronze pedestal on which the bust rested, which was in itself a remarkably fine and perfect piece of designing. The pedestal was triangular in shape, its columnar ornamentation—the upper and lower members—having all the simplicity and severity of Egyptian outlines. The decoration of the base with a certain orientalism in the arrangement of the pyramidal designs and the lotus—the sacred flower of the Nile—all worked in as an accessory to the detail.

Our next engraving is from an exhibit made by a Philadelphia firm, who have had the products of their factories in every one of the great exhibitions where their work, by its beauty and finish, as well as its artistic design, has always attracted great attention. But Cornelius & Sons, the firm of whom we are speaking, quite outdo themselves in the quality of the work they have prepared for exhibition in this our first great International Exposition.

Our illustrations of a Hall Lamp and a Chandelier, shown on pages 289 and 290, are taken from their collection containing many specimens equally meritorious. In these days, when the correct furnishing of our homes is a matter of careful study and reflection; when true art principles are beginning to prevail, and attention is paying to the fitness of means to ends; people are making search for good and beautiful forms in the most ordinary appliances as well as in the more permanent objects, called fixtures. Cornelius and Sons have not only met this demand in their special line of goods, they even have stimulated it by exhibiting freely to the public thoroughly artistic designs. Such a hall lamp as the one we illustrate is as much an ornament to the apartment it illuminates as a statue in marble or bronze. So, too, with the Chandelier: the ele-

gance and lightness of its proportions, the richness of its effect when all its burners are lit, is most noteworthy. It is with such every-day surroundings as these that we make our homes really and truly beautiful.



"The Great Exhibition, 1876."

SHAKESPEARE.
By Mitchell, Vance & Co.

[The Main Building.]

Another superb exhibit in the same branch of industry was that made by Messrs. Pancoast & Archer, of New York, from whose display we engrave, on pages 291, 292 and 293, a beautiful chandelier

and two Hall Standards, all graceful in design and well calculated to please the most critical observer.

Our next engraving—on page 293—is of a kind to require but little description other than to call attention to its technical merits and to indicate the materials and method of its construction. It represents a pair of large double doors very highly polished, suitable for the entrance into a drawing-room, or into any of the more elaborate apartments of a mansion. It is an excellent specimen of the work of Messrs. Allen & Bro., of Philadelphia. The

and separated by fillets of a chaste design, are narrow panels of the



WALL-CLOCK.

By Mitchell, Vance & Co.

leaves of this door are composed of highly-polished walnut, with ornamented panels of alternate strips of precious woods of different colors, giving a pleasing relief and effect of light and shade. Scroll patterns and some curved lines are introduced into the lock-rail and break the severity of the outlines. On each of the main panels a finely-finished bit of hand-carving has been affixed by way of ornamentation, and the scroll surrounding them is happily introduced to lighten the upper panels. The lower divisions of the jambs are inlaid with slabs of finely variegated marbles, above which,



"The Great Exhibition, 1876."

VANITY.

By Mitchell, Vance & Co.

[The Main Building

same precious woods as the door; the whole being surmounted at

the lintel by an elaborate design in high relief, which gives to the jambs the effect of pillars, of which these reliefs are the capitals.

It is remarkable that common as was the use of doors among the ancient Egyptians, none of those used in their temples have ever been found. But that there were doors is evidenced by the holes in the side-posts or pillars in which the hinge-pins were fastened. It is possible that as the Egyptians were metal-workers these doors were of metal, but those used in their houses were usually framed of wood and often stained first, as at the present day. These doors were either double or single, and fastened by a bolt or bar similar to those now in use. The Bible contains many allusions to the door and entrance to the house, and in several places allusion is made to the custom of placing a man against the door-post and pinning his ear to it with an awl, in token of servitude.



PEDESTAL AND VASE.

By Mitchell, Vance & Co.

In the description of the building of Solomon's Temple we have the following description of the magnificent carved doors of the oracle and the temple:—

“And for the entering of the oracle he made doors of olive tree: the lintel and side posts were a fifth part of the wall. The two doors also were of olive tree; and he carved upon them carvings of cherubim and palm trees and open flowers, and overlaid them with gold, and spread gold upon the cherubim, and upon the palm trees.

So also made he for the door of the temple posts of olive tree, a fourth part of the wall. And the doors were of fir tree: the two leaves of the one door were folding, and the two leaves of the other door were folding. And he carved thereon cherubim and palm trees and open flowers: and covered them with gold fitted upon the carved work."

It was also the custom in Egypt to build the better class of houses with a porch or portico in front of the entrance door, supported by columns elaborately ornamented with wreaths and garlands, decorating

the frieze also, and inscribing thereon some legend of greeting or welcome.

Another custom among the Egyptians was the hanging of all doors opening on the street in such a manner that they opened inward. This, too, was the custom of the Romans, where it was made requisite by law. But it is a curious fact that the reverse of this was the practice in Greece, where, when a person was about going out of a house, he took the precaution to give several loud raps from within, in order to warn passers-by on the outside that



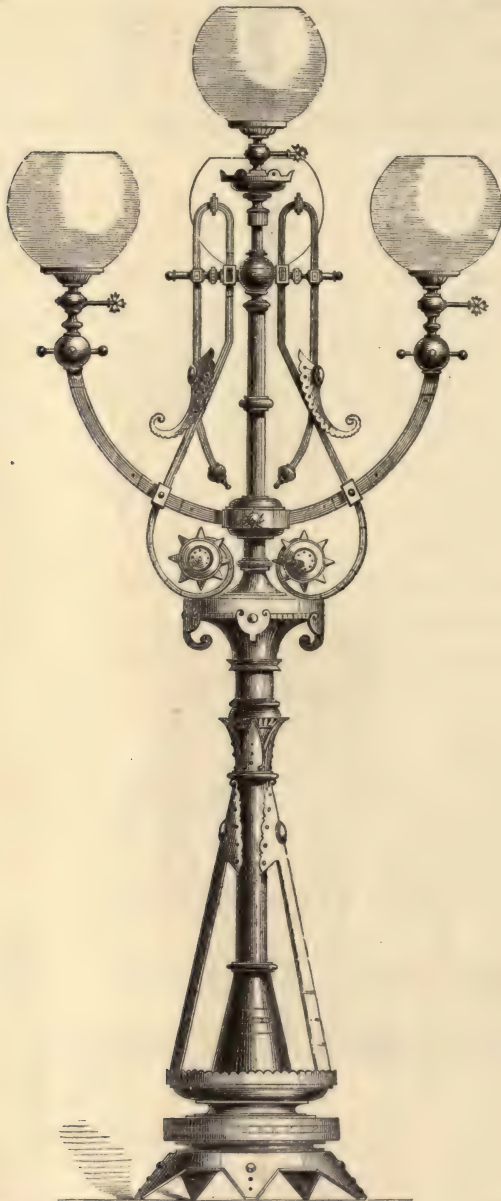
"The Great Exhibition, 1870."

CHANDELIER.
By Cornelius & Sons.

[The Main Building.

the door was about to be opened. There is a growing tendency in

this country to make certain homely articles of furniture appear,



["The Great Exhibition, 1876."]

HALL LAMP.

By Cornilins & Sons.

[The Main Building.]

when not in actual service, to be something other than they really

are. Theoretically, this tendency is a bad one, because it partakes more or less of sham, which, if we may be permitted to use the figure of speech, is a partially-explored country of vast extent, though without determinate limits, whose inhabitants and all their belongings are regarded with suspicion and contempt by the honest people who have seen how unsatisfactory and unreal everything belonging to them proves to be. But in the modern manner of living, there are certain conditions of existence which justify a certain amount of deception and indeed,



STANDARD

By Pancoast & Archer.

render it altogether praiseworthy. Here, for example, is a young couple of moderate means, who cannot afford to keep house or to rent a suite of rooms in the neighborhood where it is desirable for them to live. If, however, they could manage to live in a single apartment, they could readily afford to remain near their friends. The cabinet-maker of to-day steps in and tells them that nothing is easier. He will supply them with furniture that shall make of the one apartment a bed-room which can be turned into a parlor at a moment's notice. He provides them with a bedstead

which, by some ingenious mechanism, transforms itself into a sofa, a wash-stand that becomes a writing-desk, a wardrobe that has the



"The Great Exhibition, 1876."

CHANDELIER.
By Pancoast & Archer.

[The Main Building.

appearance of a secretary, and the thing is done. Now, all this is a very proper and justifiable proceeding. Our young couple do not want to receive friends in a room which suggests its use as a bed-

room, and they cannot sleep on parlor furniture; but in this way their difficulty has been removed.

If we follow the fortunes of this imaginary pair, and look in upon them again when their economy at the start has enabled them to have a house of their own, luxuriously furnished with all the appliances of wealth and culture, we find a corresponding desire to make things answer for several useful purposes, and by this economy of room gain more space for what is purely ornamental. In the sleeping-room for instance, where there is now no necessity for concealing



STANDARD.

By Pancoast & Archer.

the bed, we find such a wardrobe as that of Volmer's—engraved on page 295. In itself it is a superb piece of furniture; but in place of a paneled door we have a broad mirror, which thus gives just that much wall-space for pictures or what ornaments we please. Then, on either side of the mirror-door are spaces nicely contrived to hold the numberless little articles—statuettes, vases and pretty toilet articles—that women love to have about them. Beneath the broad slab at the base of the glass is a roomy drawer, and on each side of it cupboards, where the “mysteries”

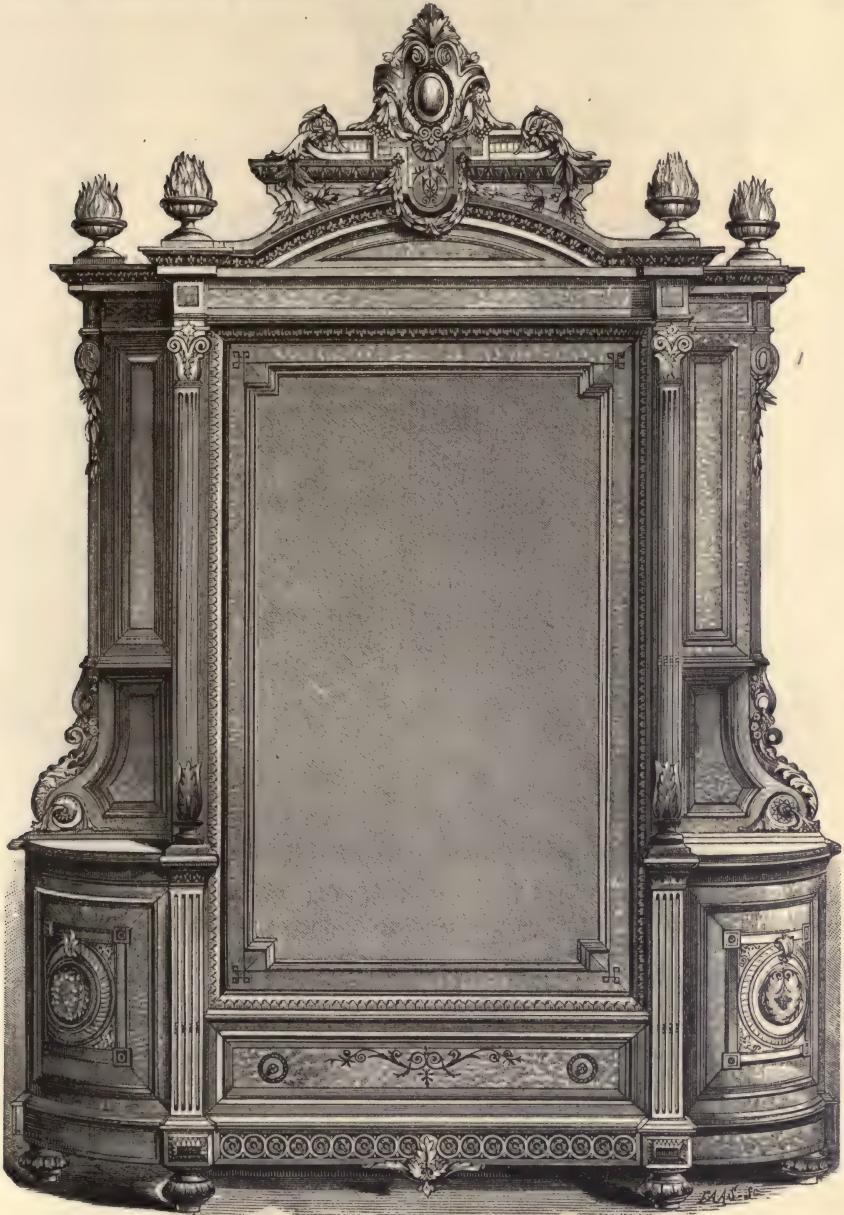


"The Great Exhibition, 1876."

DOOR.
By Allen & Brother.

[The Main Building

of the toilet or the jewel-box may be kept under lock and key. So

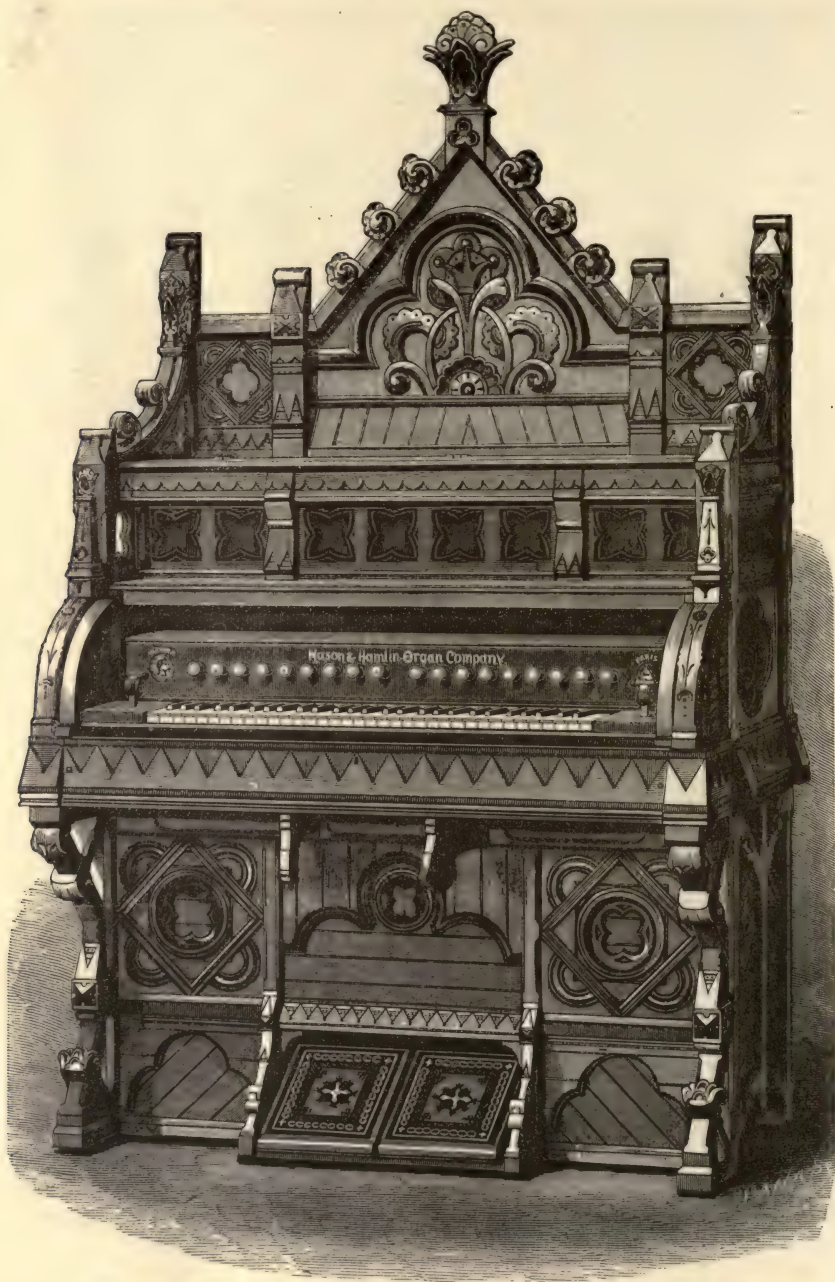


"The Great Exhibition, 1876."

WARDROBE.
By G. Volmer.

[The Main Building.

that in short we have an article of furniture combining several uses,



"The Great Exhibition, 1876."

EASTLAKE ORGAN.
By Mason & Hamlin.

[The Main Building

all grouped together into a form of artistic beauty. The elaboration and finish of the work is excellent. The light, delicate color of the satin-wood ground is relieved by the rich mahogany decorations. The elegantly-curved lines of the design, the finely-wrought scroll-work, the harmonious combination of effect at the top, all help to



"The Great Exhibition, 1876."]

PIANO.—EBONY CASE.

[The Main Building.

By Hallett, Davis & Co.

make this wardrobe a real work of art, an addition to its primary use as a piece of necessary furniture.

"When Music, heavenly maid, was young," Pan piped upon a reed and Apollo played upon his flute; and both reed and flute were the essence of simplicity and grace. When David exorcised the evil spirit from Saul with his harp, the instrument was still picturesque and beautiful. But when music became more complex and more specialized, the difficulty of putting the "soul of sound" into a worthy

dwelling-place became evident. What can be uglier than an ordinary piano, with its carved legs supporting a clumsy, oblong mass of mahogany or rose-wood? It is one of the mysteries of cabinet-making that we cannot get straight-legged furniture.* The makers



"The Great Exhibition, 1876."]

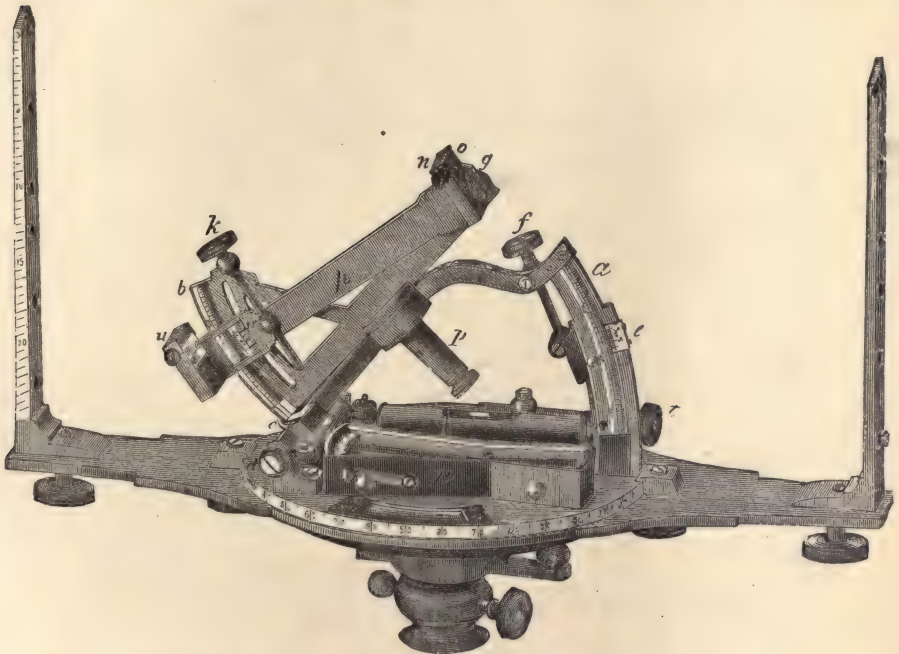
SURVEYORS' TRANSIT.

By W. & L. E. Gurley.

[The Main Building.]

have got it into their heads that the curve is the line of beauty, and it is of no use to urge that the grain of wood is straight, and that, in consequence, every deviation from a right line must detract from the strength of the material. We must meet them on the æsthetic ground, and say at once that a bow-legged piano or table is as ugly as a bow-legged man.

The beauty of musical instruments, moreover, should always lie rather in their shape and adaptation to their purpose than in the richness of their ornamentation, which is in better taste if subdued and simple. In this respect the instrument selected for illustration on page 296 is without fault. Messrs. Mason & Hamlin have constructed an organ which we doubt not has all the excellent qualities of tone and resonance for which their instruments are noted, and



"The Great Exhibition, 1870."

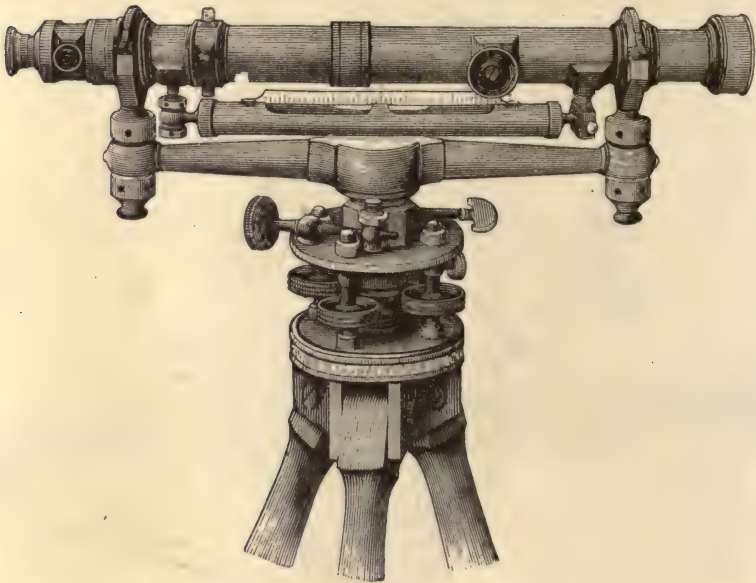
SOLAR COMPASS.

By W. & L. E. Gurley.

[The Main Building.]

whose exterior is pleasant to the eye. The decoration is quiet and massive, and often of great beauty. It is conceived in the Eastlake design, so far as that can be carried out in the construction of an organ. Our own taste would suggest an even simpler arrangement of the mouldings and panelings, and a straightening of the lower lines; but we ought to be sincerely grateful to Messrs. Mason & Hamlin for giving us an instrument free from all the abortions in the shape of ornament with which many pretentious instruments are disfigured. The public taste in this respect is rapidly improving.

There are some beautiful pianos in the English Department of the Exhibition—faultless in style and taste, though generally at a price beyond the ordinary reach. But this expensiveness is an accident, and will soon disappear. When once machinery has been constructed for turning straight legs, straight legs will be no more costly than crooked. In the meanwhile, we must pay the penalty for living in an age of transition. After a time, perhaps, we shall not regret even the pipe of Pan, “blinding sweet by the river,” or the



"The Great Exhibition, 1876."]

TWENTY-INCH Y-LEVEL.

By W. & L. E. Gurley.

[The Main Building.

flute of Apollo victorious over Marsyas. That sweet, easy melody of an age when performer and artificer were one, has given place to grand orchestras and full choruses. Music has a power and a scope undreamed of by the ancients. When we listen to Wagner's Centennial March, we feel that the visible form and body of so potent a spirit as that which resides in a full orchestra is a matter of secondary importance.

The superb Piano, which we illustrate on page 297, was manufactured by Messrs. Hallett, Davis & Co., of Boston, and is



"The Great Exhibition, 1876."

CANDELABRA.
By J. L. Mott Iron Co.

[The Main Building.

undoubtedly the most elaborately constructed instrument of its kind at

the Exhibition. The case is made of ebony, with an occasional inlaying of narrow strips of precious wood to give effect to the ornamentation. The reader will see from our engraving how remarkable this ornamentation is. All of it is hand-



work, the production of skillful carvers. Much of it is in very high relief; other portions, such as the birds and urn on the upper portion and the wreaths at the base, are worked



"The Great Exhibition, 1876."



[The Main Building.]

STATUETTES.
By John Rogers.

out in full; while the panels, with their wreaths, scrolls, medallions and symbolic figures, are elaborated with great fidelity of detail.

It is one of the anomalies of art that the piano, which contains



"The Great Exhibition, 1876."

STATUETTES.

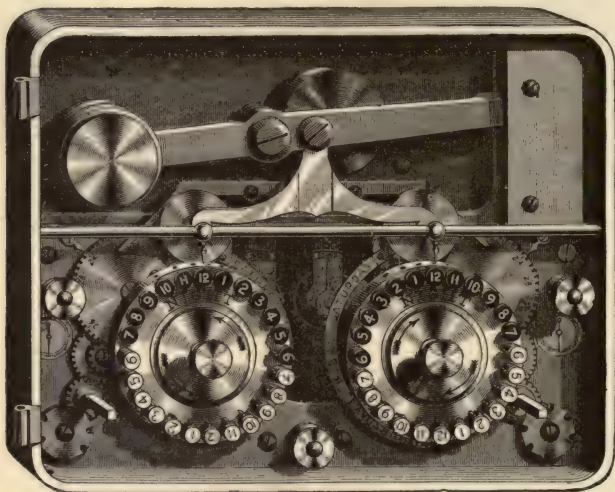
By John Rogers.

[The Main Building.

the soul of harmony, is generally the least harmonious and ungraceful appearing object of the modern drawing-room. It is usually bow-

legged and veneered, badly shaped and worse decorated. The old-fashioned spinet was decidedly superior, as far as looks go, to the modern "grand." England in her new Renaissance makes Greek and Elizabethan drawing-rooms with furniture to match, but she has not evolved an Eastlake piano, yet. We are glad, therefore, to claim for an American the honor of having made a piano that is harmonious both within and without.

This piano placed in a music-room would form, as its use requires it should, the central and prominent ornament of the apartment.



"The Great Exhibition, 1876."

INTERIOR OF CHRONOMETER LOCK.

[The Main Building.

By the Yale Lock Co.

Then the general design and ornamentation are of such a character that they can be repeated, with proper modifications, in all the other articles of furniture in such a way that each may accord with the others and the *tout ensemble* be perfect.

On page 299 we engrave a Solar Compass exhibited by Messrs. W. & L. E. Gurley, of Troy, New York. The Solar Compass is an instrument most ingeniously contrived for readily determining a true meridian or north and south line, invented by William A. Burt, of Michigan, and patented by him in 1836. It has since come into general use in the surveys of the United States Public Lands, the principal lines of which are required to be run with reference to the

true meridian. The invention having long since become the property



"The Great Exhibition, 1876."

THE MINUTE-MAN
By New England Granite Co.

[The Main Building

of the public, Messrs. Gurley have given their attention to the manufacture of these instruments.

The Solar Apparatus consists mainly of three arcs of circles by which can be set off the latitude of a place, the declination of the



"The Great Exhibition, 1876."

MEMORY.

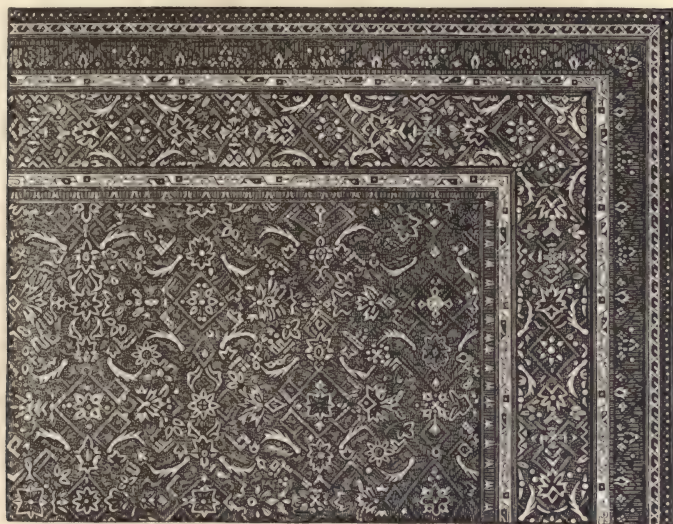
[The Main Building.

By New England Granite Co.

sun and the hour of the day. These arcs, designated in the engraving by the letters *a*, *b* and *c*, are therefore termed the latitude, the declination and the hour arcs, respectively. The Latitude Arc, *a*, has its

centre of motion in two pivots, one of which is seen at *d*, the other is concealed in the engraving. It is moved either up or down within a hollow arc—seen in the engraving—by a tangent screw at *f*, and is securely fastened in any position by a clamp-screw. The latitude arc is graduated to quarter degrees and reads by its vernier, *e*, to single minutes; it has a range of about thirty-five degrees, so as to be adjustable to the latitude of any place in the United States.

The Declination Arc, *b*, is also graduated to quarter degrees and has a range of about twenty-four degrees. Its vernier, *v*, reading to



"The Great Exhibition, 1876."

CARPET.
By Bigelow Carpet Co.

[The Main Building.

single minutes, is fixed to a movable arm, *h*, having its centre of motion in the centre of the declination arc at *g*; the arm is moved over the surface of the declination arc and its vernier set to any reading by turning the head of the tangent-screw, *k*. It is also securely clamped in any position by a screw.

For the Solar Lenses and Lines at each end of the arm, *h*, is a rectangular block of brass, in which is set a small convex lens, having its focus on the surface of a little silver plate, fastened by screws to the inside of the opposite block. On top of each of the rectangular blocks is seen a little sighting-piece, termed the Equa

torial Sight, fastened to the block by a small milled head-screw, so as to be detached at pleasure. They are used in adjusting the different parts of the solar apparatus.

The Hour Arc, *c*, is supported by the two pivots of the latitude arc, already spoken of, and is also connected with that arc by a curved arm, as shown in the figure. The hour arc has a range of about one hundred and twenty degrees, is divided to half degrees and figured in two series; designating both the hours and the degrees, the middle



"The Great Exhibition, 1876."

CARPET.
By Bigelow Carpet Co.

[The Main Building.]

division being marked 12 and 90 on either side of the graduated lines.

The Polar Axis through the centre of the hour arc passes a hollow socket, *p*, containing the spindle of the declination arc, by means of which this arc can be moved from side to side over the surface of the hour arc, or turned completely round as may be required. The hour arc is read by the lower edge of the graduated side of the declination arc. The axis of the declination arc, or, indeed, the whole socket, *p*, is appropriately termed the polar axis.

Besides the parts shown in the engraving seen on page 299, there is also an arm used in the adjustment of the instrument,

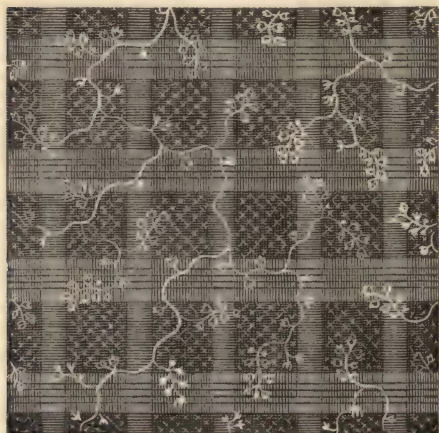
but laid aside in the box when that is effected. These parts constitute properly the solar apparatus. Besides these, however, are seen the needle-box, *n*, with its arc and tangent-screw, *t*, and the spirit-levels, for bringing the whole instrument to a horizontal position. The Needle-box has an arc of about thirty-six degrees in extent, divided to half degrees, and figured from the centre or zero mark on either side. The needle, which is made as in other instruments, except that the arms are of unequal lengths, is raised or lowered by a lever shown in the engraving. The needle-box is attached, by a projecting arm to a tangent-screw, *t*, by which it is moved about its centre and its needle set to any variation. This variation is also read off by the vernier on the end of the projecting arm, reading to single minutes a graduated arc, attached to the plate of the compass.

The Levels seen with the solar apparatus, have ground-glass vials and are adjustable at their ends. The edge of the circular plate on which the solar work is placed, is divided and figured at intervals of ten degrees and numbered, as shown, from 0 to 90 on each side of the line of sight. These graduations are used in connection with a little brass pin, seen in the centre of the plate, to obtain approximate bearings of lines which are not important enough to require a close observation.



AMERICAN PRINTS.
American Print Works.

The inside faces of the sights are also graduated and figured to indicate the amount of refraction to be allowed when the sun is near the horizon. The same firm also exhibit a Surveyor's Transit, which we engrave on page 298, and a Twenty-inch Y-Leveling Instrument,



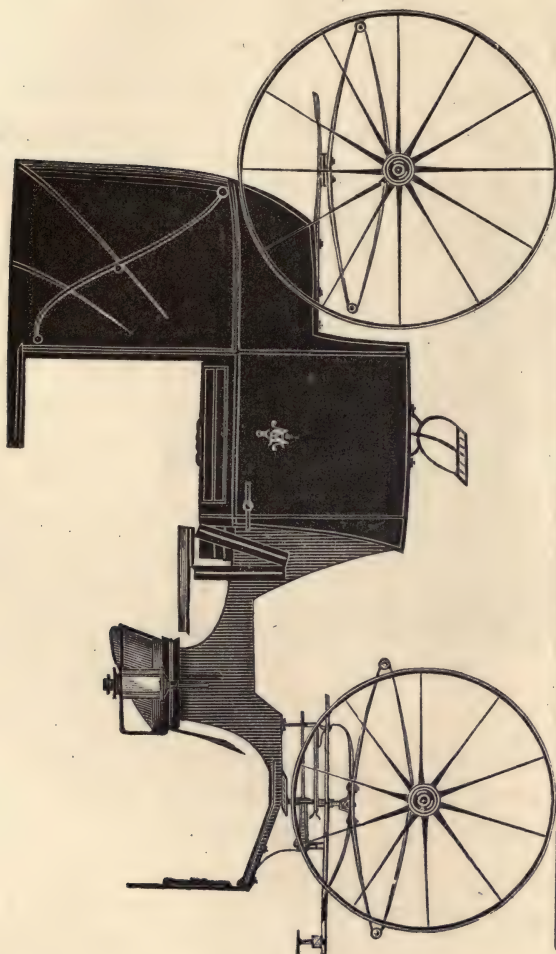
AMERICAN PRINTS.
American Print Works.

engraved on page 300. Of the different varieties of the leveling instrument, that termed the Y-Level has been almost universally preferred by American engineers, on account of the facility of its adjustment and superior accuracy.

The telescope has at each end a ring of bell-metal, turned very truly and both of exactly the same diameter; by these it revolves in the wyes, or can be at pleasure clamped in any position when the clips of the wyes are brought down upon the rings, by pushing in the tapering pins. The telescope has a rack and pinion movement to both object- and eye-glasses, an adjustment for centering the eye-piece, and another for ensuring the accurate projection of the object-glass, in a straight line. Both

of these are completely concealed from observation and disturbance by a thin ring which slides over them. The telescope has also a shade over the object-glass, so made that whilst it may be readily moved on its slide over the glass, it cannot be dropped off and lost. The interior construction of the telescope represents a longitudinal

section and exhibits the adjustment which ensures the accurate projection of the object-glass slide. As this is peculiar with Messrs. Gurley's instruments and is always made by the maker so permanently as to need no further attention at the hands of the engineer,



The Main Building.

BROUGHAM.
By Durham & Wooster.

"The Great Exhibition, 1876."

we shall here describe the means by which it is effected, somewhat in detail.

The necessity for such an adjustment will appear when we state that it is almost impossible to make a telescope tube so that it shall

be perfectly straight on its interior surface, Such being the case, it is evident that the object-glass slide, which is fitted to this surface and moves in it, must partake of its irregularity, so that the glass and the line of collimation depending upon it, though adjusted in one position of the slide, will be thrown out when the slide is moved to a different point. To prove this, let any level be selected which is constructed in the usual manner, and the line of collimation adjusted upon an object taken as near as the range of the slide will allow; then let another be selected, as distant as may be clearly seen; upon



CARPET.

Court of the Netherlands.

this revolve the wires, and they will almost invariably be found out of adjustment, sometimes to an amount fatal to any confidence in the accuracy of the instrument. The arrangement adopted by this firm corrects this imperfection and perfectly accomplishes its purpose.

As seen in the engraving, the level telescope is furnished with the ordinary rack and pinion movement to both object- and eye-tubes. The advantages of an eye-piece pinion are that the eye-piece can be shifted without danger of disturbing the telescope, and that the wires are more certainly brought into distinct view, so as to avoid effectually any error of observation arising from what is termed the instrumental parallax. The position of the pinion on the tube is varied in different instruments according to the choice of the engineer.

The Level or ground-bubble tube is attached to the under side of the telescope and furnished at the different ends with the usual movements, in both horizontal and vertical directions. The aperture of

*French Court.]***LACE.**
Maison Blanc.

the tube is about five and one-fourth inches long, being crossed at the centre by a small rib or bridge, which greatly strengthens the tube.

The level scale, which extends over the whole length, is graduated into spaces a little coarser than tenths of an inch and figured at every fifth division, counting from zero at the centre of the bridge; the scale is set close to the glass. The bubble-vial is made of thick glass tube, selected so as to have an even bore from end to end, and finely ground on its upper interior surface, that the run of the air-bubble may be uniform throughout its whole range. The sensitiveness of a ground-level is determined best by an instrument called a level-tester, having at one end two Y's to hold the tube, and at the other a micrometer-wheel divided into hundredths and attached to the top of a fine-threaded screw, which raises the end of the tester very gradually. The number of divisions passed over on the perimeter of the wheel, in carrying the bubble over a tenth of the scale, is

the index of the delicacy of the level. In the tester which is used a movement of the wheel ten divisions to one of the scale indicates



"The Great Exhibition, 1876."

PORCELAIN VASE.
Collective Exhibit of Gien.

[The Main Building.

the degree of delicacy generally preferred for railroad engineering. For canal work practice, a more sensitive bubble is often desired, as for instance, one of seven or eight divisions of the wheel to one of

the scale. The exhibit of Messrs. Gurley is a most interesting and satisfactory one, and we trust these gentlemen will gratify and instruct the public by continuing their display in the permanent exhibition.

At the large iron fountain in the eastern part of the Main Avenue, the Mott Iron Company made a beautiful display of artistic iron-work, from which we engrave, on page 301, a candelabra in bronze

which is a representative piece of work from their creditable display.

Mr. Rogers, whose fine statuettes are now familiar



"The Great Exhibition, 1876."

DISH AND VASES.

By J. Houry.



[The Main Building.

throughout the length and breadth of the land, exhibited the choicest specimens of his artistic work in various buildings of the Exhibition. On pages 302 and 303 we engrave several of those always interesting and pleasing subjects.

Near to the southeast corner of the Main Building, the Yale Lock Company made a beautiful exhibit of a Post Office, the interior of which was open to visitors. They also exhibited several varieties of their time or chronometer locks, for safes, one of which we engrave on page 304, showing the interior of such a lock.

On the avenue between the Shoe and Leather Building and Machinery Hall, a fine collection of statuary in granite was exhibited by the New England Granite Company.

No more appropriate exhibit could have been made by this Company to our Centennial than the spirited statue, an engraving of which

fields and the plow, shouting to them as he went galloping past, "the British are coming!" In a few hours, over a hundred men of the "train-band"—as it was sometimes called—were collected together.

we present to our readers on page 305. It is a statue typifying the brave company of men who banded themselves together in the early days of the Revolution, swearing to be ready at a moment's notice to stop whatever work they might be at and take up their arms against the invader. It is a "Minute Man," one of those brave fellows whom Paul Revere, in his memorable ride of the 18th of April, 1775, called from the



CANDELABRA.
By Susse freres.

and the next morning, under gallant Captain John Parker, the little band stood drawn up in the streets of Lexington determined to fight for those liberties which were dearer to them than life. Every



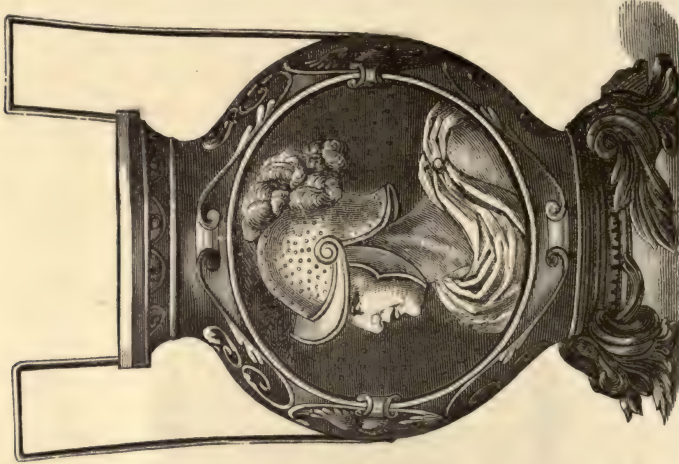
"The Great Exhibition, 1876."]

CLOCK.
By Susse Freres.

[The Main Building.

schoolboy is familiar with the events of that day—the famous 19th of April—and the part played by the famous Minute-Men afterwards. But we can appropriately introduce here those charming verses

delivered by Ralph Waldo Emerson on the unveiling of the statue last year on the one-hundredth anniversary of the famous battle:—



[The Maid Briding.



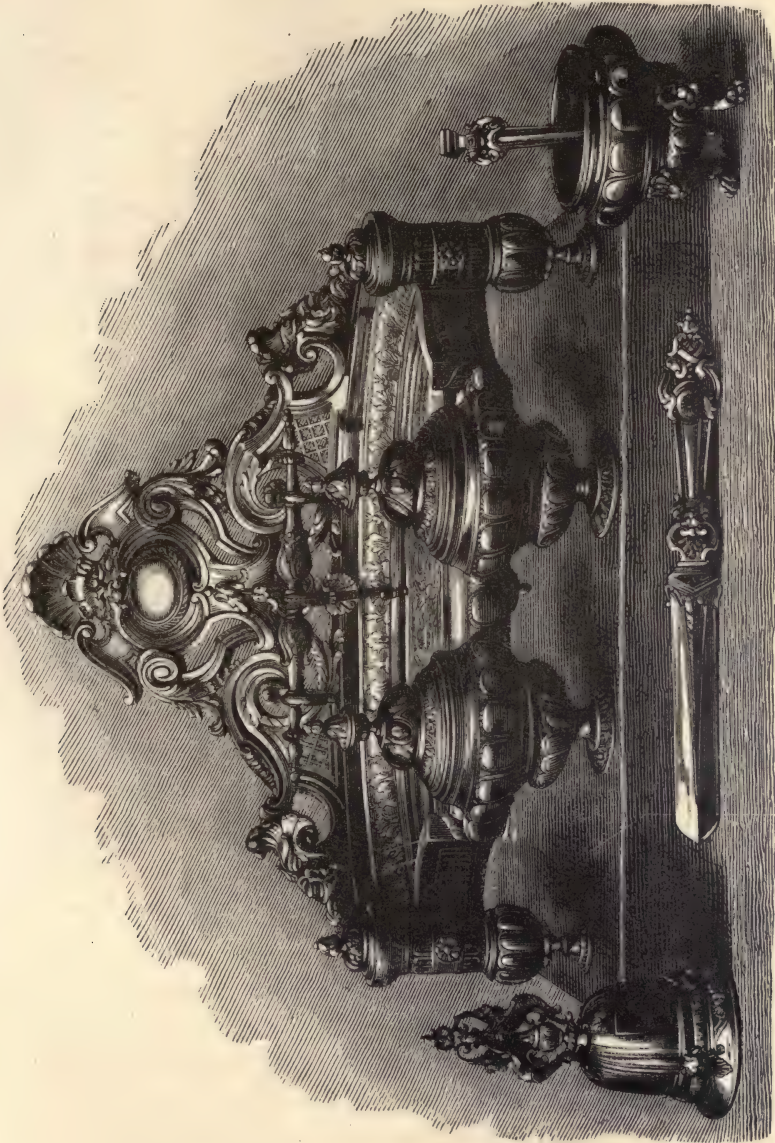
ENAMELS.
By M. Pottier.

“The Great Exhibition, 1876.”

By the rude bridge that arched the flood,
Their flag to April's breeze unfurled;
Here once the embattled farmers stood,
And fired the shot heard round the world.

The foe long since in silence slept;
Alike the conqueror silent sleeps;
And time the ruined bridge has swept
Down the dark stream which seaward creeps.

On the green bank, by this soft stream,
We set to-day a votive stone;



|The Main Building.

BRONZE INKSTAND.

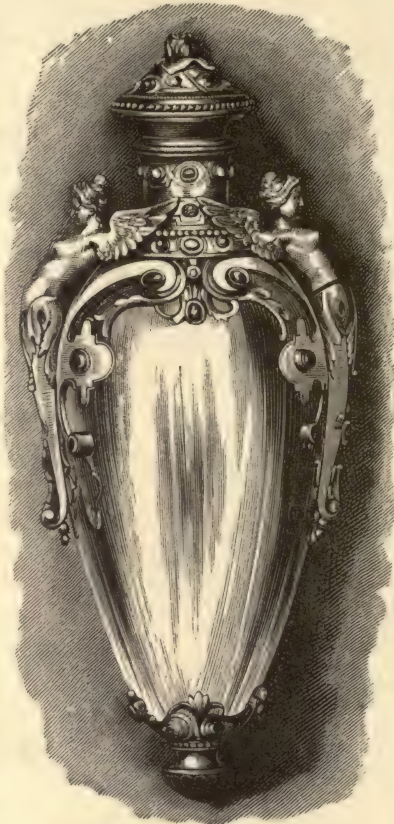
By M. Perrot.

"The Great Exhibition, 1876."

That memory may their deed redeem
When, like our sires, our sons are gone.

Spirit that made those heroes dare
 To die and leave their children free,
 Bid Time and Nature gently spare
 The shaft we raise to them and Thee.

The statue itself needs but little description. The reader can see for himself how admirably the artist has embodied the idea. The man stands in strong, free position, one hand resting upon the plow he is about leaving, the other, grasping the musket, is extended forward, and over the arm is thrown the cloak as if hastily picked up at the sudden summons. The face wears a look of determination—the look of one who is ready



SMELLING-BOTTLE.

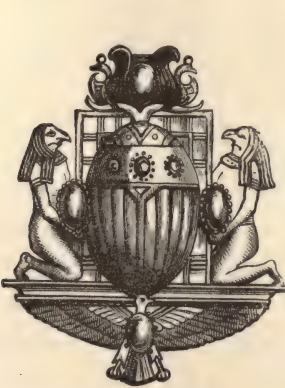
By E. Phillips.

to do and die if need be—and the sculptor has given with rare art a loftiness, a look almost of prophecy to the expression.

Our next illustration is also drawn from one of the Fine Arts, which becomes Industrial only by its adaptation to machinery and susceptibility of reproduction. We do not expect from any machine the qualities of imagination and creative thought

which make a great sculptor, yet when the conception is simple, and especially when the shaping hand of the artificer is allowed to give the final touch, the result may be a memorable one, to such perfection have mechanical processes now arrived. Our illustration represents a more legitimate use of such appliances than American chromolithographs. "Memory," engraved on page 306, is represented by a

female figure, whose face indicates the time of life between girlhood and middle age. She is old enough to have a past, regrets and losses, happy and unhappy memories; but life is still high in her veins, and the future is still before her. Her thoughts now are with the past. She is seated on a mass of rock, in the attitude of remembrance and retrospection. Her face shows a softened, half-regretful mood; her eyes are downcast and half-closed; she has forgotten time and place. The left hand, lying on the lap, holds a chaplet of roses. The right arm lies across the left. Notice the ease of the position, and yet the absorption indicated in every turn of limb. One knee is raised, and the foot supported upon a slab of rock; the other foot is upon a



"The Great Exhibition, 1876."



[The Main Building.]

BROOCHES.
By E. Phillips.

lower stone, half slipping off, yet supported by the heel. The attitude and feeling of the statue are difficult to render by means of Industrial Art, and the designer has achieved a remarkably good result.

On pages 307 and 308 are two specimens of carpet from the Bigelow Carpet Manufactory of Massachusetts. They are of the quality known as Turkey ply, that peculiar finish into which the foot sinks as into moss, and which has a warmth and comfortable feeling suggestive of rest and repose. The patterns of the body of these carpets are unmistakably oriental, and the border follows the same model.

We engrave on pages 309 and 310 some of the Print Patterns used by the American Print Works, Fall River, Massachusetts, in their manufacture: and as these figures may fairly be taken to represent the fashion of the day, it is curious and interesting to note how much we have

improved in this respect within the past few years. It is not so very long ago—say when our grand dames were girls—that the young creatures thought themselves very fine indeed if they were attired in robes on which impossible peacocks and birds of paradise—whose plumage was



SEVRES VASE.

anything but terrestrial—were displayed. We find examples of these in the colored prints of the time, and occasionally one is discovered in a long forgotten trunk and preserved as a precious accessory for tableaux. At a later period, indeed, within the recollection of many of us, dresses were covered with great

sprawlings in glaring, ill contrasted colors, such as none but a savage of to-day would delight in. And now we have such patterns as these—neat, carefully designed, with proper regard for the color-effect, and altogether pleasing and attractive to the eye.

A useful annex to the Main Building was situated between the Art Gallery and the Department of Public Comfort. It was the

Carriage Building, but portion of it given up to domestic heating



"The Great Exhibition, 1876."

HELICON VASE.

By Elkington & Co.

[The Main Building.

apparatus. From the exhibit of Messrs. Durham & Wooster, of New Haven, we engrave on page 311 a neatly-made Brougham.

Of the principal national exhibits still to inspect, we have the Netherlands, Switzerland, Belgium and France; but we must at this stage content ourselves by directing the attention of the reader to the beautiful objects engraved on the last twelve or thirteen pages of this division of our work. It will be observed that the last illustration, taken from the Main Building, is the Helicon Vase, exhibited by Messrs. Elkington & Co., of Birmingham; and as this was the greatest object of Industrial Art in the Exhibition, we appropriate this page to a description of that superb work.

The materials of which the Helicon Vase is composed are oxydized silver and steel—the latter damascened. The piece is designed to symbolize the Apotheosis of Music and Poetry. In form, the piece may be described as an elongated plateau, the surface sloping upwards to the centre, on which rests the vase. The plateau is enriched with sculptured panels and medallions, and around the border is a series of twelve bas-reliefs, of various shapes, illustrative of the different kinds of Music and Poetry. The interstices of the design are filled in with scrolls, masks and trophies of various kinds, formed of beaten silver, which is thrown into relief by the background of dark, richly damascened steel. Resting on the plateau, at the foot of the vase, are two half-dressed female figures, symbolizing Music and Poetry, attended by youthful genii.

On the body of the vase, on either side, is a large medallion relief, in *repoussé*, representing the nine Muses, four on one and five on the other. At the bases of the handles are escutcheons bearing the names of illustrious poets and composers: Homer, Shakespeare, Molière and Byron, on the one side, and Handel, Haydn, Beethoven and Mozart, on the other.

The foregoing is but a bare description of this great work; no words can convey an adequate idea of its fine workmanship and artistic designing. To state that the art labor alone bestowed upon it cost thirty thousand dollars in gold, is but to give the figures representing the commercial value of an expression of genius which cannot be bought, but comes to man as a gift.

PART III.

MACHINERY HALL

AND ITS

ANNEXES.





MACHINERY HALL.



BEFORE entering into our review of the Machinery and Civil Engineering of the Exhibition, we shall furnish a few details of the principal building in which they are placed.

Machinery Hall forms a rectangular parallelogram, broken in the centre of the south side by a square projection, which is called the Hydraulic Annex, on either side of which are the annexes of the Shoe and Leather Building, the Machine Shop for repairs, and the Boiler Houses of the Corliss Engine, the English boiler exhibit, and the American boiler exhibit. To the west of the Main Hall are the Pavilion of Chili, with models of the process of extracting silver from its ores; the Glass-works of Gillender & Son; the Spanish Pavilion, with its exhibit of machinery and implements of war; the Canadian log-house, and the shed with machinery for sawing lumber and stone.

The Machinery Hall, like the Main Building, in its length runs east and west, and forms a continuous line—interrupted only by Bel-



"The Great Exhibition, 1876."

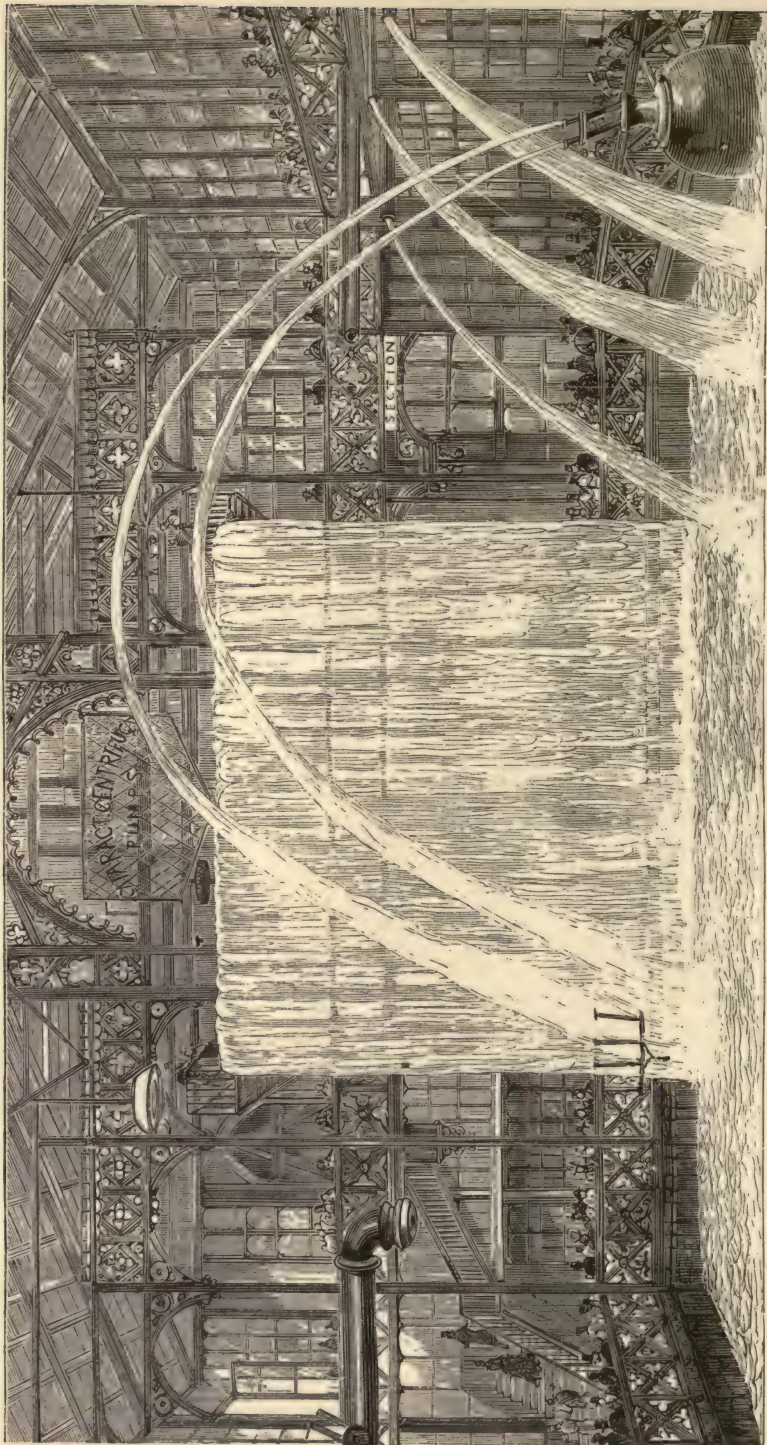
MACHINERY HALL.

[Machinery Hall.

mont Avenue—with that building. The distance from the east end of the Main Building to the west end of Machinery Hall is 1278 yards, and the whole length from east to west, along the Avenue of the Republic, is one mile. Machinery Hall is 1402 feet long by 360 wide, and the Hydraulic Annex is 208 by 210 feet; these cover an area of 558,440 square feet, or 12.82 acres; or, including the upper floors, the building provides 14 acres of floor-space. The principal portion of the structure is one story in height, showing the main cornice upon the outside at 40 feet from the ground, the interior height to the top of the ventilators in the avenues being 70 feet, and in the aisles 40 feet. To break the long lines upon the exterior, projections have been introduced upon the four sides, and the main entrances finished with facades, extending to 78 feet in height. The east entrance forms the principal approach from street-cars, from the Main Exhibition Building, and from the railroad depots. The west entrance affords the most direct communication with George's Hill, which point affords the best view of the entire Exhibition grounds.

The foundations consist of piers of masonry. The superstructure consists of solid timber columns supporting roof trusses, constructed with straight wooden principals and wrought iron ties and struts. As a general rule the columns are placed lengthwise of the building, at the uniform distance apart of 16 feet. The columns are 40 feet high to the heel block of the 90 feet span roof trusses over the avenues, and they support the heel of the 60 feet spans over the aisles, at the height of 20 feet. The outer walls are built of masonry to a height of 5 feet, and above that are composed of glazed sash placed between the columns. Portions of the sash are movable for ventilation. Louvre ventilators are introduced in continuous lengths over both the avenues and the aisles. The building is lit entirely by side light. The annex for hydraulic machines contains a tank 60 feet by 160 feet, with depth of water of 10 feet. In connection with this hydraulic machinery is exhibited in full operation. At the south end of this tank is a waterfall 35 feet high by 40 feet wide, supplied from the tank by the pumps upon exhibition.*

* Commissioners' Report.



"The Great Exhibition, 1876."

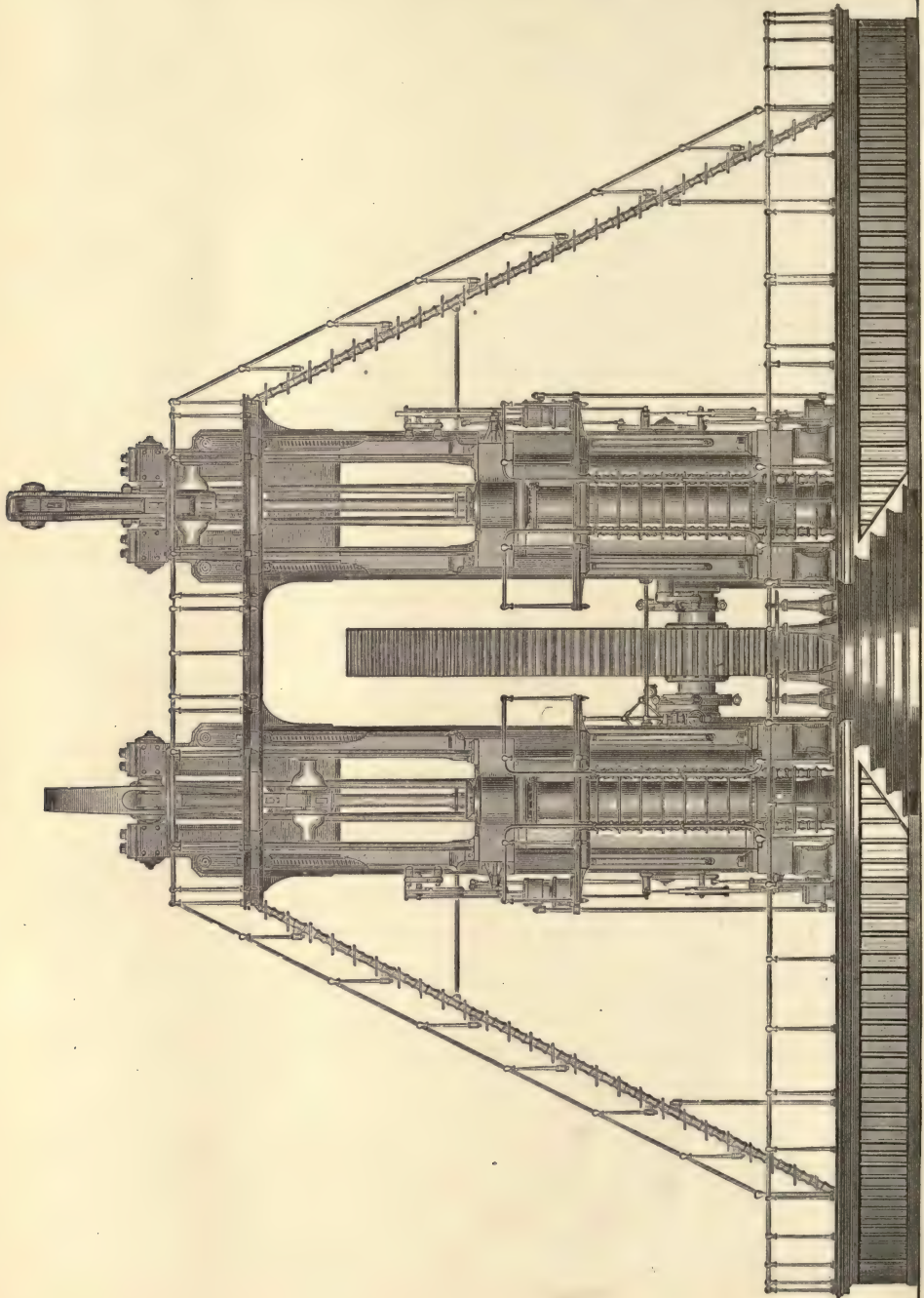
THE CATARACT.
Hydraulic Annex.

[Machinery Hall.]

Entering Machinery Hall at the southern door, we pass the office of that bundle of false information—the Official Catalogue—and on the right the most destructive instruments of modern warfare—the Krupp guns. Continuing on this aisle we pass the British exhibit of Mining Machinery and Machinery of the Soil (exclusive of agricultural machinery), American Machine Tools, and English Machinery for working in Iron. Passing the Corliss exhibit on the right and the Hydraulic Annex, the most remarkable of the American exhibits are the Drilling Machinery, American manufactures of the Perrin ribbon-saw—a general collection of knick-knacks of Machinery—until we reach the western end, when turning, we pass the principal exhibits of Turbine machinery, sewing-machines, power-looms, watch-making, models of boats, marine machinery, armor-plating, life-saving apparatus, the foreign exhibits of Russia, Canada, France, Belgium; the sugar-mill from Glasgow, Scotland; and proceeding westward again on the north aisle, we pass the exhibits of Germany, Sweden, Brazil; printing machinery of all kinds, locomotives, and the most wonderful of all in the Machinery Hall—perhaps in the whole Exhibition—the Grant Calculating Machine for the use of mathematicians and astronomers. Next we pass weighing and testing machines, and find ourselves once more at the western end, note-book well filled with what we have found here, in the Main Building, United States Government Building, and various pavilions.

Mineral products have, in the arrangement of the present Exhibition, as in former ones, been brought under Class I, which, however, includes a number of other objects in addition to mineral bodies, whether in their natural state or as prepared by the metallurgical processes for further treatment in the arts. Such are, for example, the models, drawings or the actual apparatus of mechanical appliances used in mining.

It appears natural that an Industrial Exhibition should commence by placing before the spectator the raw materials derived from the mineral kingdom, and should lead him step by step from the simple products of the mine and the quarry, from the very source in fact of manufacturing and commercial power, towards the finished results of

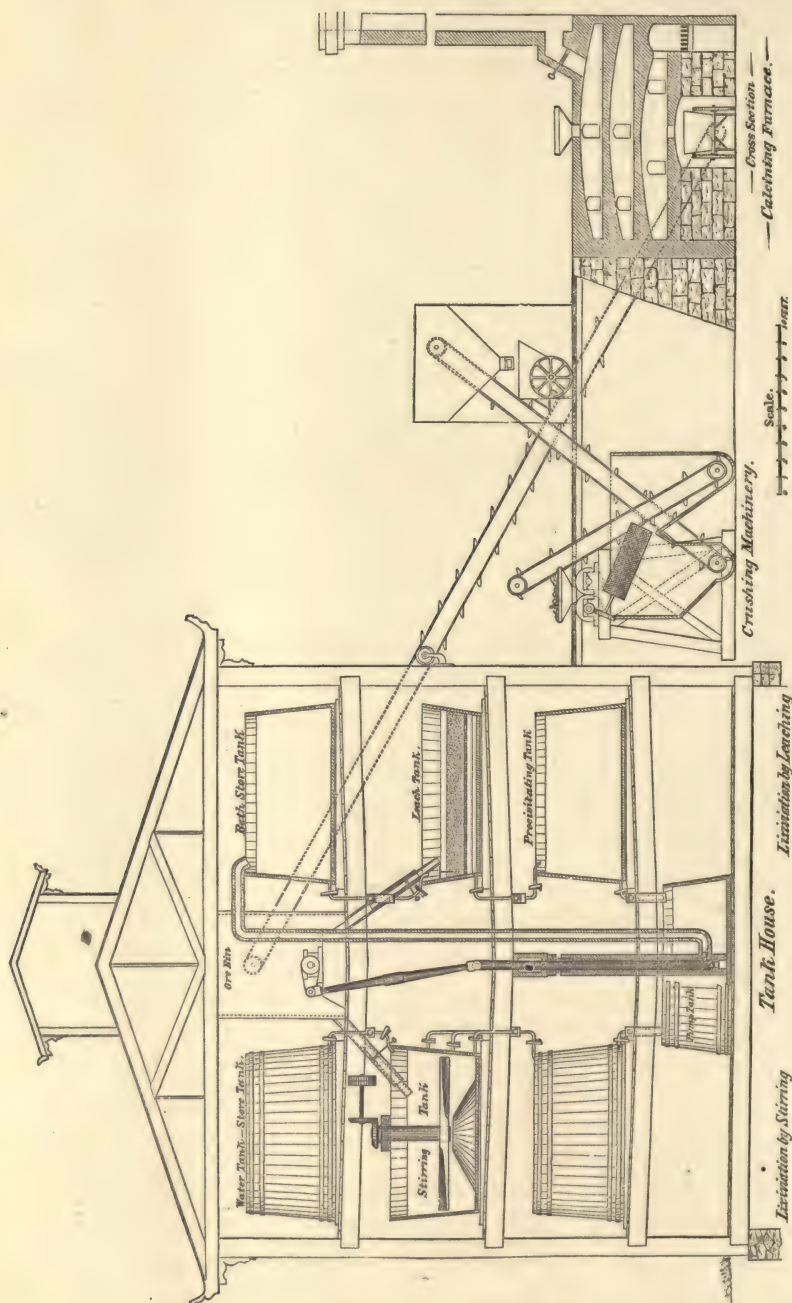


[Machinery Hall.

THE CORLISS ENGINE.

"The Great Exhibition, 1876."

industrial art with which we are more familiar in every-day life; and if this be needed to insure the completeness of such an exhibition, it might be argued that when the display is styled universal, the choice of natural products should not be limited to those alone for which mankind have already found an application, but that all the substances offered to us by a bountiful nature should receive their due meed of attention, and should contribute, it may be only to general instruction, but possibly also, after comparison and suggestion and trial, to new and useful forms of service to man. If any one applies himself seriously to the study of the mineral products as exhibited, he will find provoking gaps and intervals and examples of incompleteness, such as could only be obviated by the collection of the larger groups of specimens being placed under the direction of a master mind. But there is a great deal besides this to be taken into account, and in which Class I differs *toto cælo* from those classes which offer to the eye of the visitor the products of art in a state of complete finish. A large proportion of the specimens constituting this division—as, for instance, the coals, the ironstones, and many of the ores—require a previous education to enable the visitor to discover their interest, and are not likely to enlist the close attention of the million, wearied with the multitude of sights and *blasé*, with the brilliancy of porcelain and silver, silks and gilding. Hence arises a feeling that such collections will interest but a small portion of the public. And coupled with this is the question whether any pecuniary advantage is secured to the exhibitor by a display of his raw produce. In some instances the place held in the Exhibition may serve as a useful advertisement; but in many others there is such a total absence of money remuneration that we can hardly wonder that many producers hang back, and we may be the more grateful to those who have incurred an expense, sometimes very considerable, to send up suites of their copper ores, black-bands, limestones, etc., and to accompany them by drawings and sections, in order to contribute to the general scientific usefulness of the undertaking. But more than this, if previous knowledge is required in order to invest the specimens with their due share of interest, much more is it needed if we

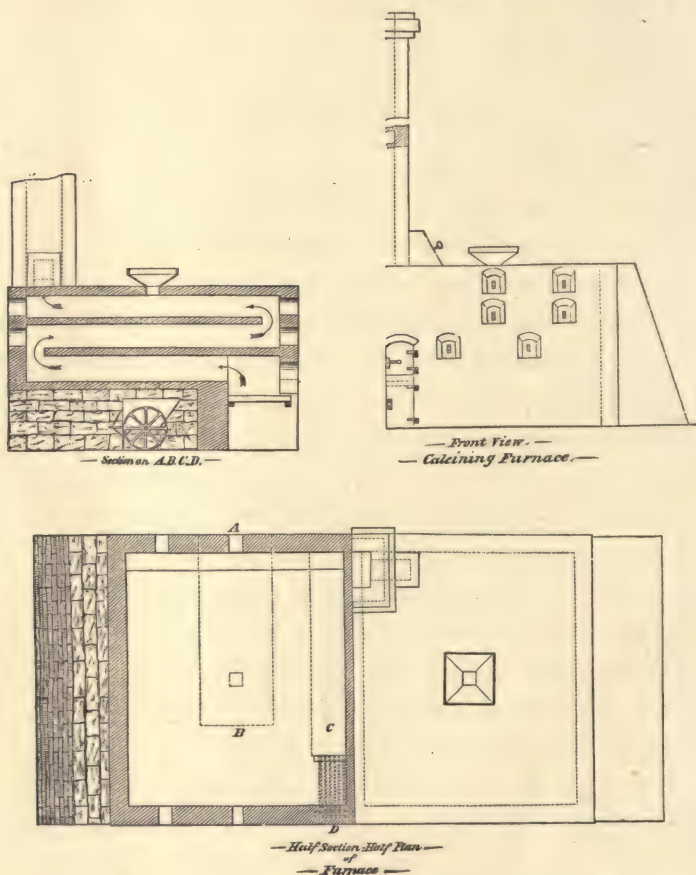


would judge of the commercial value and importance of the works which they represent. The prosperous working of a mine, the successful treatment of an ore, depend on such a multitude of collateral circumstances, that a mere example or two, in most cases carefully selected as the most showy that can be obtained, cannot possibly serve as an index to the true state or prospects of the work from which they are taken, unless we are made acquainted by previous experience, or by detailed description, with the conditions under which such examples occur.

It appears to us that under this latter point of view the system adopted in the preparation of the Official Catalogue is highly objectionable. Therein we see that most of the exhibitors simply state the nature of the objects exhibited by them, and generally in so few words, being enjoined by authority so to do, as to be obscure or far short of the required mark in explanation. But when we turn to others, we are surprised to find, after the first simple statement, a long panegyric upon the articles exhibited, often coupled with assertions of much importance if true, which would appear to the public to be issued under the authority of the Commissioners, but which, we regret to learn, are nothing else than paid advertisements. It thus becomes the more needful that exhibition records and jury reports should be published at as early a date as possible, in order to counteract, were there no other reason for it, the erroneous impressions which may in some instances be produced by the desire of exhibitors to puff their wares, and of Commissioners to make their catalogue pay.

There are two general methods employed for the reduction of the metal copper from its ores—one the old system of repeated fusions, or the smelting process, always used in the case of rich ores, and the other designated the wet process, by which the material containing the metal is subjected to the action of a solvent which dissolves the copper out, leaving the other ingredients behind as a residue. This wet process has been very extensively used in the extraction of copper from lean or poor ores, which could not be profitably worked by the old method. Rich ores are easily smelted, and the proportion of fuel used compared with the metal obtained is small; but as the

percentage of copper decreases, the difficulty of separation increases, and the amount of fuel required becomes greater, making the operation too expensive for practical use. With the wet process, however, only one furnace operation is generally required, and but



PROCESS FOR THE REDUCTION OF COPPER FROM ITS ORES.

By Hunt & Douglas.

little fuel. To reduce a ton of copper from a five per cent. ore by the smelting process would consume about fifteen tons of coal, while only three tons would be necessary in obtaining the same amount by the wet process. There are, however, expenses in the latter method which do not obtain in the former, the principal one being the precipitant necessary to throw down the copper from its

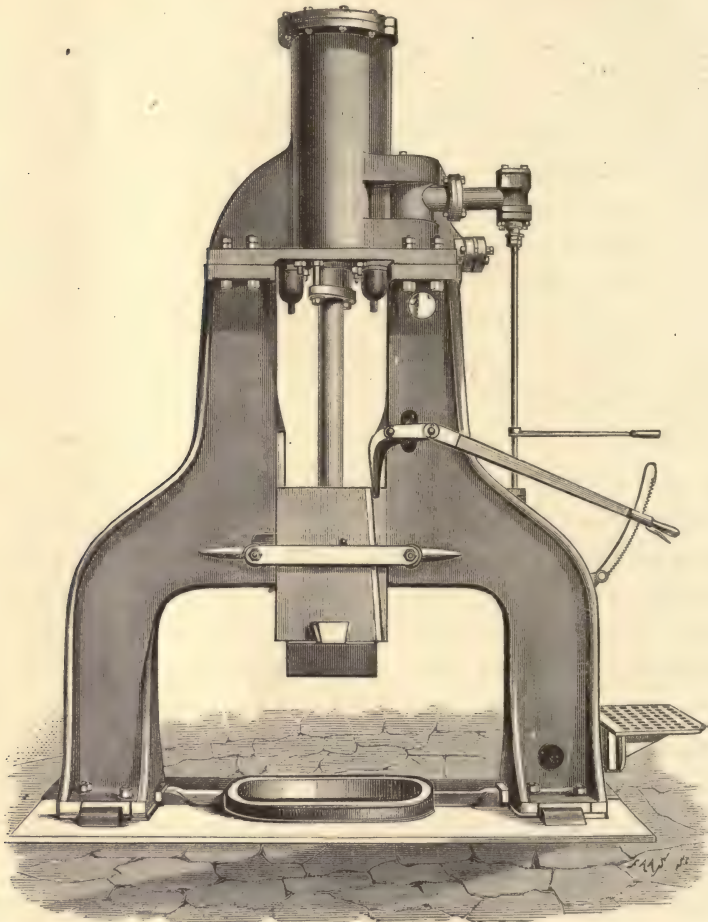
solution. The amount of this varies directly with the amount of copper obtained; and while its use as compared with the consumption of fuel by the other process makes the wet method the most economical for a low-grade ore, it does not do so for a rich ore. The manner of procedure must therefore vary with the kind of ore available.

The precipitant usually employed in the wet process is metallic iron, depositing the copper in a pure state, and it depends on the form in which the copper exists in solution how much iron is required. With the proto-salts one ton of copper will require nearly a ton of iron, the atomic weight of the latter being a little less than the former, while with the sub-salts less than half a ton will be necessary.

In England copper is reduced from some six hundred thousand tons of Spanish pyrites annually, most of the sulphur having been first extracted for the manufacture of sulphuric acid by roasting the already partially roasted ore with salt. By this means the copper is converted into proto-chloride, becoming soluble in water; and to render the process still more certain, the water is acidulated with muriatic acid, which at the English extraction works is almost a waste product. The solution is then brought into contact with the metallic iron, which precipitates the copper, and the liquid, containing chloride of iron, is thrown away. At some works in England and on the Continent, where acid is a waste product and carbonates of copper are available, the copper is extracted simply by acids. Both these methods are exceedingly effective, but are applicable only where salt and acids are very cheap, which is nowhere the case in this country.

In order to utilize a secondary product of sulphuric acid manufacture, Mr. Monnier patented in the United States, some years ago, a process which consisted in sulphatizing, and thus rendering soluble in water, the copper in sulphuretted ore, by roasting with sulphate of soda, and he obtained, when his method was worked with skill, very satisfactory results. The limited supply of the reagent, however, and its cost elsewhere than at the chemical works, interfered with the general adoption of the process.

Copper is very generally distributed, almost every one of the United States claiming copper-mines, but the ores are seldom abundant enough in one place to justify the erection of works at the mines, or sufficiently rich to bear transportation to a market.



"The Great Exhibition, 1876."

HAMMER.
By Ferris & Miles

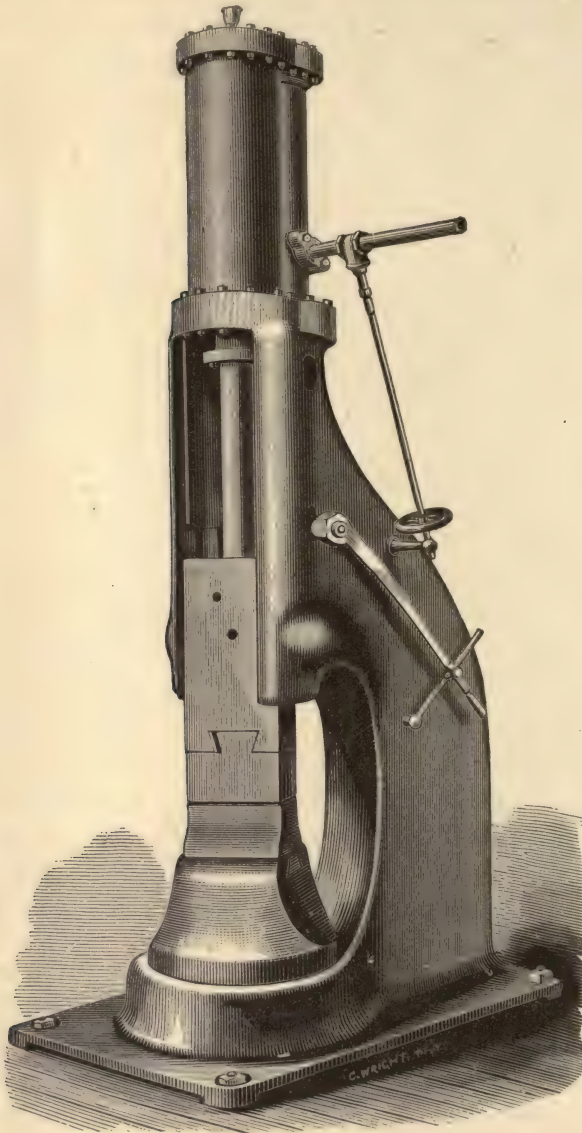
[Machinery Hall.]

Displays are contributed to the Exhibition from quite a number of localities, both of ores and furnace products. The Chemical Copper Company, of Phoenixville, Pennsylvania, exhibits in the Government Building a series of specimens illustrative of a wet

method called the Hunt & Douglas Process, showing the ores treated, the different steps of the method employed, and the marketable product obtained. In the exhibit of the American Society of Civil Engineers, in the west gallery of the Main Exhibition Building, is shown a drawing of the works, from which we have taken our engraving on pages 334 and 336. Messrs. Hunt & Douglas claim as the chief merit of their process, the use, as an efficient solvent, of the waste liquors containing chloride of iron which are run off as worthless after the precipitation of the copper in the salt and acid methods. They find that a solution of chloride of iron, when used in connection with a strong brine, dissolves readily the copper from either, naturally or artificially, oxidized ores. They therefore make such a solution by dissolving, in the proper proportions, sulphate of iron (copperas) and salt, or in any other convenient way, and in this solution, heated to about 150° Fahr., they digest the ore, which if massive must first be ground to such fineness that its copper contents will be exposed. If the ore is already oxidized by nature, and consists of a native carbonate or oxide, or a silicate like chrysocolla, it will yield up its copper to the solvent without other treatment; but if the copper be combined with sulphur, it must first be roasted to drive off the sulphur and oxidize the metal.

Ores that are very slimy, and form mud on settling, must be agitated with the chloride of iron solution in vats provided with a stirring apparatus, as shown in the engraving, while if the ores be coarse and gritty, they may be laid a foot or more in depth on the false bottom of a leach-tub, and the solvent solution be allowed to filter slowly through them. This method by filtration is slower but quite as thorough as by agitation. The chloride of iron in passing through the ore reacts with the oxide of copper, and there results an insoluble peroxide of iron and a mixture of soluble chloride and dichloride of copper which flows into the precipitating tanks, where it comes into contact with metallic iron, and the copper is thrown down in crystalline metallic grains. The liquor becomes recharged with chloride of iron, and ready

therefore to be pumped back into a storage tank and heated so



SINGLE HAMMER.

Ferris & Miles.

that it may be used over again and passed through the ore to dissolve a fresh charge of copper. The solvent is thus constantly

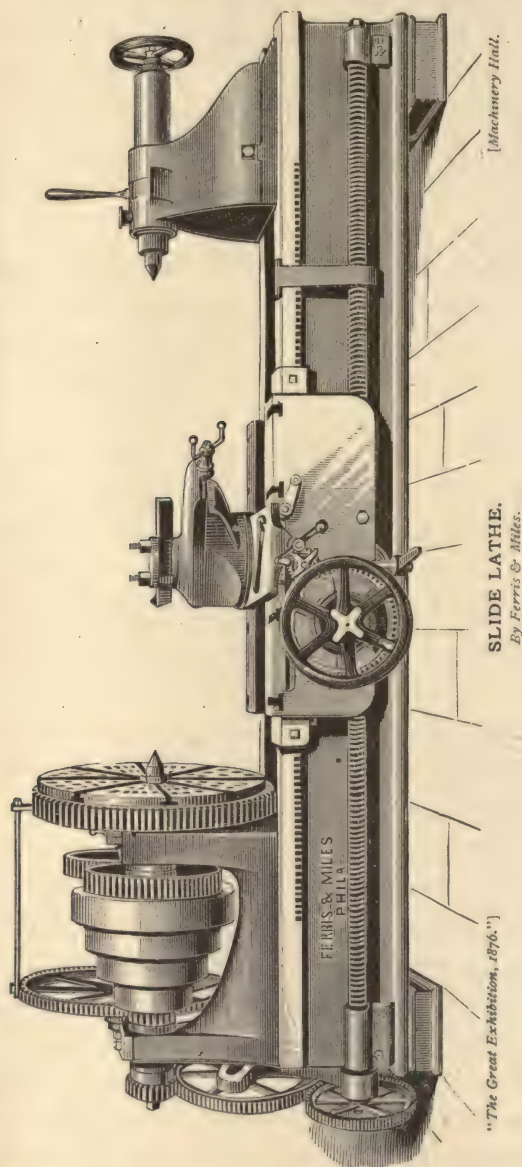
regenerated, and the same liquor circulates indefinitely, alternately charged with chloride of copper and with chloride of iron. The only reagents used are a little salt, which must be added from time to time to supply inevitable loss, and the iron consumed in precipitation. This item, however, is less than in the ordinary methods, as about two-thirds of the copper is dissolved as a dichloride (that which is kept in solution by the brine), and therefore only from sixty to seventy-five parts of iron are consumed in yielding one hundred parts of copper.

Messrs. Hunt & Douglas do not claim that the neutral solution as used will dissolve the copper as thoroughly as acids would; but if the ore be suitable and at all skillfully treated, the residue from a four per cent, ore will not retain over one-half per cent. of copper.

In the exhibits of the Chemical Copper Company may be seen some remarkably perfect and large crystals of metallic copper obtained by slow precipitation, and the ingots made from the cement by a single fusion. This method of reduction is also employed at the Ore Knob Copper Mine in North Carolina, and for the extraction of silver and copper at the Stewart Works, Georgetown, Colorado.

Messrs. Ferris & Miles, of Philadelphia, exhibit a large variety of steam hammers, one of which, known as the Double Frame Steam Hammer with Parallel Ram, is shown by the engraving on page 338. This hammer follows very closely in general arrangements the well-known steam hammers as introduced by James Nasmyth, of England, and consists of a steam cylinder mounted upon two frames, which form convenient guides for the hammer ram playing between them. The piston-rod connects the hammer ram with the piston, and operates it directly by the steam pressure in the cylinder. The ram in the present case is set parallel with the frames, although Messrs. Ferris & Miles, under one of their patents, frequently set the ram diagonally, for the purpose of enabling the operator to utilize the whole extent of the lower end of the ram for die surface, and for placing this surface in proper

direction for convenient working. To afford additional stiffness to the frames, which are box-castings, flanges are placed on their



exterior edges, and the ram is made rather thicker than the frames, projecting slightly on each side, so as to give a neat

appearance and allow the workman to readily see every motion it makes.

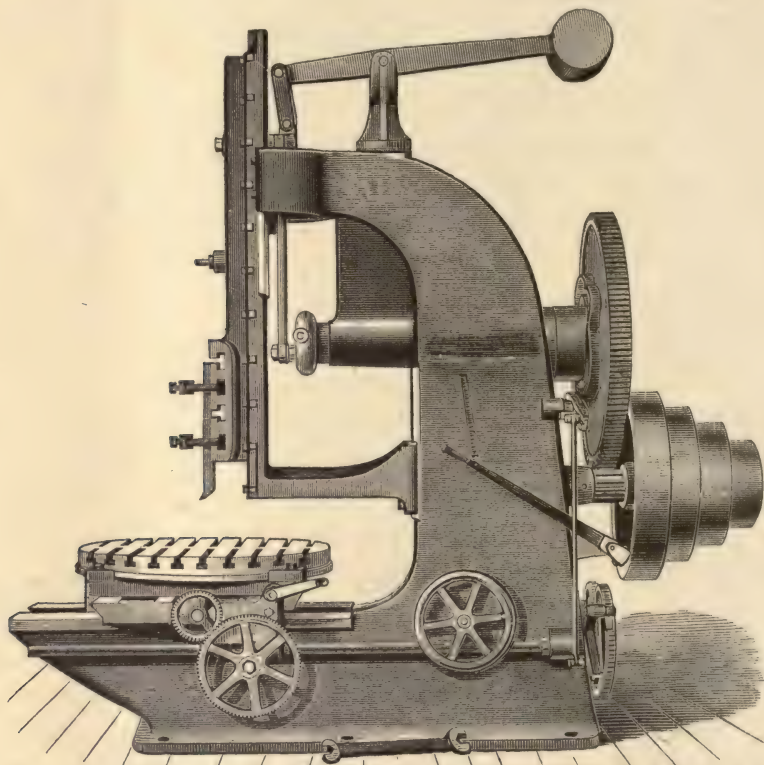
The main steam valve is a cast-iron hollow cylinder with enlarged ends, which work in cylindrical seats, where are situated the steam ports. The steam supply enters the valve chamber between the valve seats, circulating freely around the valve; and the exhaust chamber, fitted with proper drain and exhaust pipes, lies below the floor of the cylinder, allowing any condensation which may occur to drain into it. The exhaust steam from above the piston passes down into this chamber through the hollow cylindrical main valve. The valve stem making its connection with the valve in this exhaust chamber, has only atmospheric pressure on it, and requires no stuffing-box. This method of connection also prevents any disturbance of the perfect balance of the valve, as would be the case if attached on the steam side, and reduces the amount of power required to work the valve, as well as the friction of the parts, to a minimum.

Motion is given to the valve automatically by means of an inclined plane on the ram, which operates a cam, rocker or bell crank, connected by a link to the valve stem, and a hand lever pivoted on to this rocker places the whole apparatus directly under the control of the operator. The mechanism is characterized by extreme simplicity, consisting of only three pieces, and yet by means of it every possible gradation of stroke can be given, continuous or intermittent, light or heavy, dead or elastic, long or short, fast or slow, with as much ease and certainty as if the enormous machine, sometimes as much as ten tons in weight, and having a stroke of eight feet, were a mere tack-hammer in the hands of the operator.

Spring buffers below the cylinder protect it from injury, and by removing these the piston packing can be examined or replaced in a short time without disconnecting any of the other parts. Stuffing-boxes are provided at the connections of steam and exhaust pipes to prevent leakage from vibration due to action of hammer.

Drop-treadles, worked by the hammer-man's foot, are frequently fitted to the smaller sizes of hammers, which generally have only

single frames, and they work exceedingly well, stopping and starting the hammer "on the blow," the ram always stopping "up," ready to strike again. The guides are made adjustable, so that any wear can easily be taken up and the dies kept in accurate position for stamping work into moulds. Much thought has been bestowed by the makers upon the arrangement of the anvil and foundation, so



"The Great Exhibition, 1876."

SLOTING MACHINE.

By Ferris & Miles.

[Machinery Hall.]

as to provide the most perfect attainable base for the machine at the least possible expense consistent with the requirements.

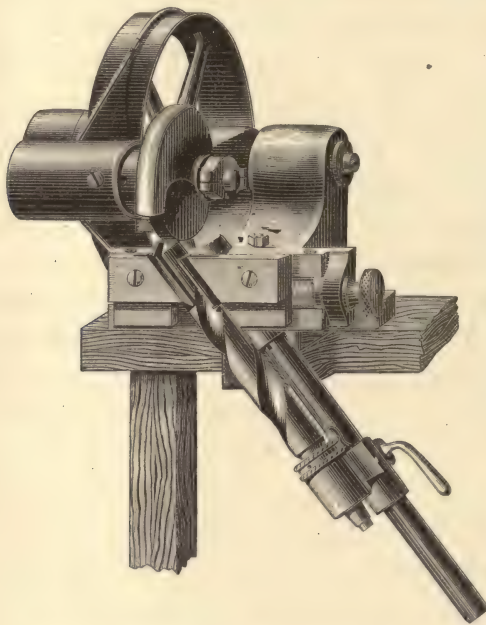
We also engrave on pages 340, 342, and 344, a Single Frame Steam Hammer, a Slide Lathe, and an improved Slotting Machine exhibited by the same firm. Every device tending to cheapen production ought to be hailed not only by manufacturers, but by intelligent workmen as well, because such tools constitute the very agency whereby high

wages can be maintained, and that nation which, never standing still, takes the lead in the perpetual introduction of this class of machinery, will be most likely to command the outlying markets of the world, notwithstanding the fact that it is to the honored names of our own countrymen, both of the past and the present, that the world is so largely indebted for the designs of many of its best tools and machinery (a fact which is fully acknowledged by all who are acquainted with the past history of such mechanism), yet we must not forget that mankind generally do not know, neither do they care much for the source of these contrivances; they are oftener guided by other considerations, chiefly those of a commercial nature, and in the present condition of the world's progress our country would throw a grand chance away were its display at this Exhibition not upheld by the best specimens of her numerous branches of machine-making and other manufactures.

A firm which has done much to uphold the credit of American machine tools among foreign nations is Wm. Sellers & Co., of Philadelphia. This firm made creditable displays at the Exhibitions of Paris, 1867, and of Vienna, 1873, obtaining at the latter place a diploma. One of their greatest novelties exhibited at Vienna, and also exhibited at the Philadelphia International Exhibition is a small machine or implement for sharpening drills, which we engrave on page 346. This operation is usually accomplished in workshops by the workman holding the end of the drill against the side or periphery of a grinding stone at the proper angle, the correctness of the operation depending entirely upon the man who manipulates the drill, and the consequence is that comparatively few drills run correctly when inserted in the drill spindle, being generally found to wobble at the centre point more or less, hence unless great care is employed, there is no certainty of precision on the hole to be drilled either as to position or dimensions, but in Sellers' drill sharpening machine, the drill fits into a socket of the same shape as the machine spindle, which is placed in relation to the emery wheel at the proper angle, and then passes under the revolving emery, first upon one side and

then upon the other, and thus the drill is made perfectly correct for its purpose. The introduction of the emery wheel instead of the stone, combined with the mechanism, is a great improvement. This system of grinding was introduced into England from the United States in 1854, and has been extensively employed for sharpening circular cutters.

Their lathes are almost perfect, the spindle seems to float on a fluid, yet it is perfectly steady, and in working has not any of the jerking feeling that is usually to be found in the second class



"The Great Exhibition, 1876."

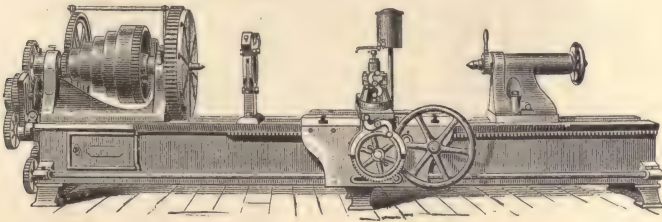
DRILL GRINDING MACHINE.

By Wm. Sellers & Co.

[Machinery Hall.

lathes. The self-acting motion is obtained from the main gearing by means of a disk working between two disks on another spindle, but both on the same axis, hence as the intermediate disks is nearer to or farther from the centre of motion so is the rate of motion that it receives. It is impossible to resist the conclusion that Messrs. Sellers are the most speculative tool makers in the Exhibition, and everything that they show is almost above criticism; their bolt screwing machine is now so well known that

scarcely any word of praise or even description is required, but still those shown are marvels of excellence, the fitting of the dies perfection, yet withal so plain and simple, so free from every attempt at ornament, and yet so harmonious in repose and in the full assurance of fitness for their purpose. Their slotting machine is somewhat peculiar, inasmuch as the sliding bar does not slide in the frame as is usual, but works in an intermediate slide rest, thus giving facility either to lower or raise the intermediate frame to suit the work, in order to have the sliding bar which carries the instrument under equally good conditions at all times and thus give extra steadiness. A trifling feature in their tools is, that the sliding bars of their countershaft arrangements are made



"The Great Exhibition, 1876."

SLIDE LATHE.

By Wm. Sellers & Co.

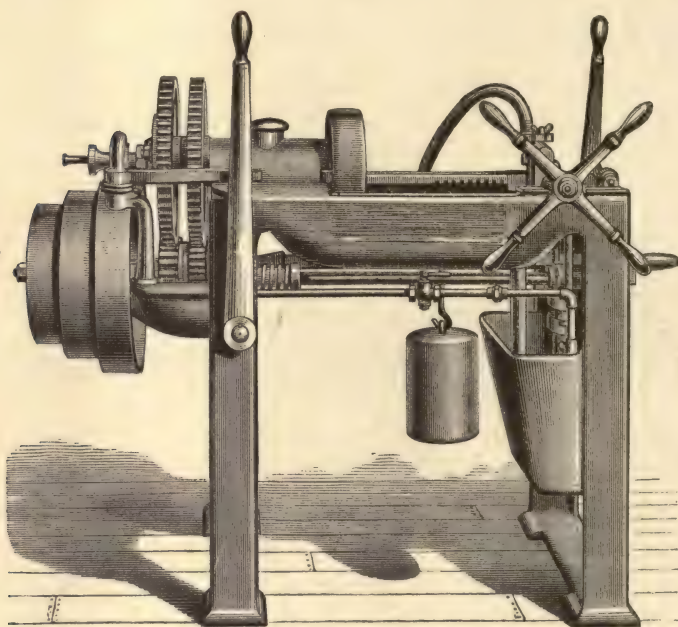
[Machinery Hall.]

of wood, they seem to answer the purpose as well as iron, and are of course both cheaper and lighter to manipulate.

Their Planing Machine differs essentially from ordinary planers, possessing peculiarities that impress the beholder at once with the amount of master-thought that has been expended upon its design. Attention is first attracted to the method by which motion is given to the table holding the object to be planed. A special form of spiral pinion being used, placed upon a driving-shaft which crosses the bed diagonally, passing out in the rear of the upright on the side next to the operator and connecting with the pulley-shaft by means of a bevel-wheel and pinion. The location of this pulley-shaft, as may be seen from the engravings, brings the driving-belts within easy reach of the workman, and the fact of its axis being parallel to the line of motion of the table permits

the machine to be placed side by side with lathes, thus economizing space in the shop. There are four teeth on the pinion, arranged like the threads of a coarse screw of steep pitch, and working into a rack on the table, the teeth of which are straight and are placed at an angle of five degrees to its line of motion, to counterbalance any tendency of the pinion to move the table sideways.

We understand that this arrangement for moving the table has



BOLT AND NUT SCREWING MACHINE.

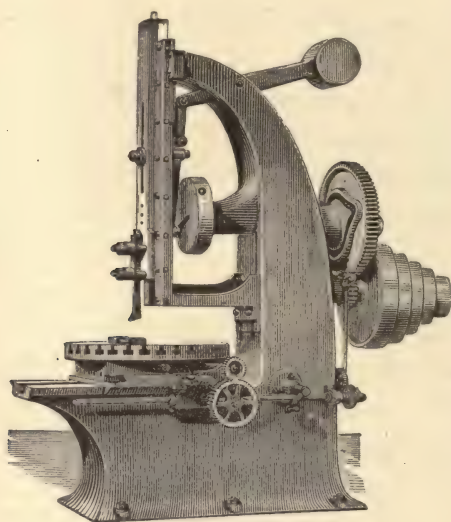
By Wm. Sellers & Co.

been found to be very durable, the operation of the teeth being more of a rolling action than a rubbing or sliding one. A strong box-shaped connection between the sides of the bed, just at the uprights, holds them very firmly together, an advantage not attainable in most other forms of planers where the methods adopted for giving motion to the table do not allow the required space. The plan of diagonal shaft adopted has another superiority in throwing the bevel-wheel and pinion driving it, out from under

the table and allowing the former to be made of any necessary size compared to the latter as may be required to give the requisite reduction in speed and transmission of power from a high-speed belt without the interposition of other gearing, whereas, in the ordinary screw-planer, the projection of the table over the ends of the bed limits the size of the gearing at the end of the screw. The method adopted for shifting the belts constitutes another novelty. An arm rises from the rear bearing of the pulley-shaft extending over the pulleys and supporting three fulcrum-pins. On the centre one is a peculiarly shaped lever, swinging horizontally between the other two upon which are placed the two belt-shifters. The shifters are operated from the middle lever by teeth or projections on each, the arrangement being such that one shifter is always moved before the motion of the other is commenced, one belt always leaving the driving-pulley before the other begins to take hold and reverse the motion, requiring but little power, allowing the least possible lateral motion of the belts and avoiding all undue straining and shrieking. The usual adjustable stops are provided on the sides of the table, operating the belt-shifting apparatus by means of a double-armed lever and link connection. The position of this apparatus is exceedingly convenient for the workman if he desires to change the belts without reference to the stops, allowing him to easily control and reverse the motion of the table by hand or even to stop it entirely by shifting both belts on to the loose pulleys without arresting the motion of the counter-shaft. This is a great advantage at times when planing surfaces of irregular shape.

The machine has positive geared feeds, self-acting in all directions with tool-lifter operating at all angles. The feed motion of the cutting-tool is obtained in nearly all planing-machines from the belt-shifter, entailing upon the stops on the table an undue amount of work and really resulting in quite limited variations of feed. The usual screw and central feed shafts are provided in this machine in the cross-head for horizontal or vertical motion, receiving the variable motion for any required amount of feed

through a ratchet-wheel fitted interchangeably to their squared end projections. This ratchet-wheel is operated by a toothed segment, which receives at each end of the stroke of the tool the required alternate movements in opposite directions by means of a light vertical feed-rod from a crank-disk below, on which the crank-pin is so arranged as to allow any variation and adjustment of throw and amount of feed that may be desired to be made during the cutting stroke of the machine. The crank-plate is alternately moved a half revolution and disengaged in either direction at each



"The Great Exhibition, 1876."]

SLOTING MACHINE.

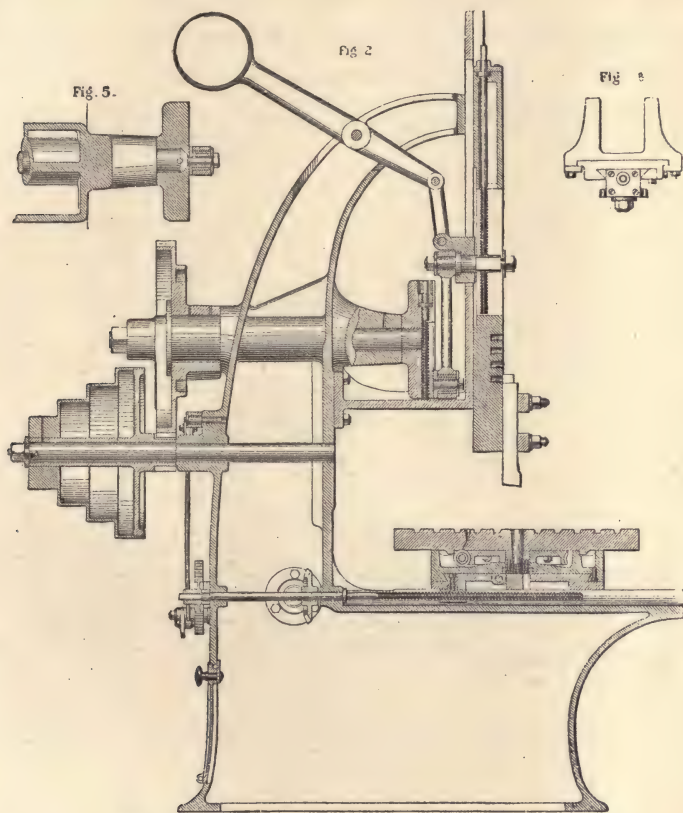
By Wm. Sellers & Co.

[Machinery Hall.

reversion of the stroke of the tool by means of an ingeniously contrived double pawl and ratchet-wheel, receiving motion from a pinion on the front end of the pulley-shaft. At each change of motion the pawl is thrown into gear by friction, keeping up a positive motion of the crank-disk by the ratchet-wheel until the pawl is disengaged from its teeth by a positive stop.

Messrs. Sellers' method of lifting the tool-point on back motion in this machine merits attention as another improvement on the usual plan, which, in most planing-machines consists in hanging the

cutting-tool in what is called an apron, so adjusted as to allow it to swing loose on the back stroke, but to be held rigidly when cutting. This arrangement is very objectionable in all fine planing, and especially in large planers where the tool is quite heavy. Various ideas have been put into practice for actually lifting the

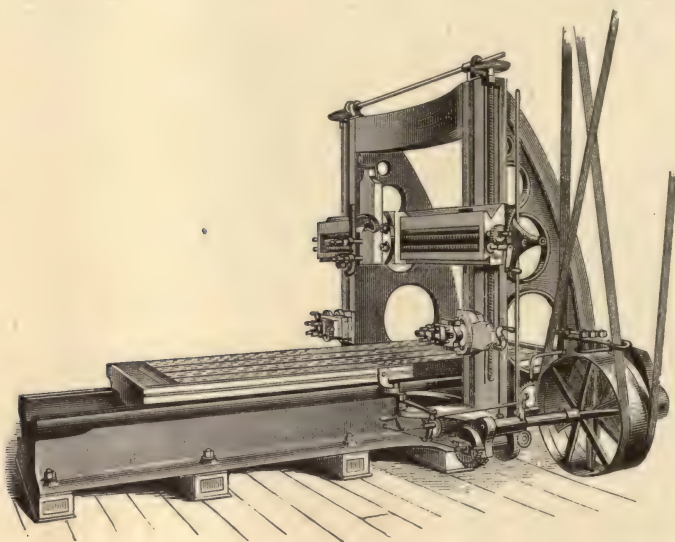


SECTIONAL VIEW OF SLOTTING MACHINE.

By Wm. Sellers & Co.

tool-point clear of the work on the back stroke and dropping it into place again ready for action on the return, but the method here shown possesses especial ingenuity, lifting the tool in every position of the side-rest, and doing so from within the cross-head without interfering in any way with the automatic feed motion, the machinery for working the feeds occupying the centre about which the adjustable part of the saddle rotates. This lifting apparatus is

operated by a cord attached to a grooved segment which is connected with the crank-plate of the feed motion by a link, a reciprocating motion being imparted to the cord corresponding with the motions of the table, and occurring only at the end of each table movement, beginning with the reversion of each stroke. The cord is guided over sheaves at the ends of the cross-head and passes around a cord-wheel in the saddle, having at its other end a weight to keep it in tension. The cord-wheel, by means of a pinion at the other end of its shaft, operates on a light annular plate-wheel



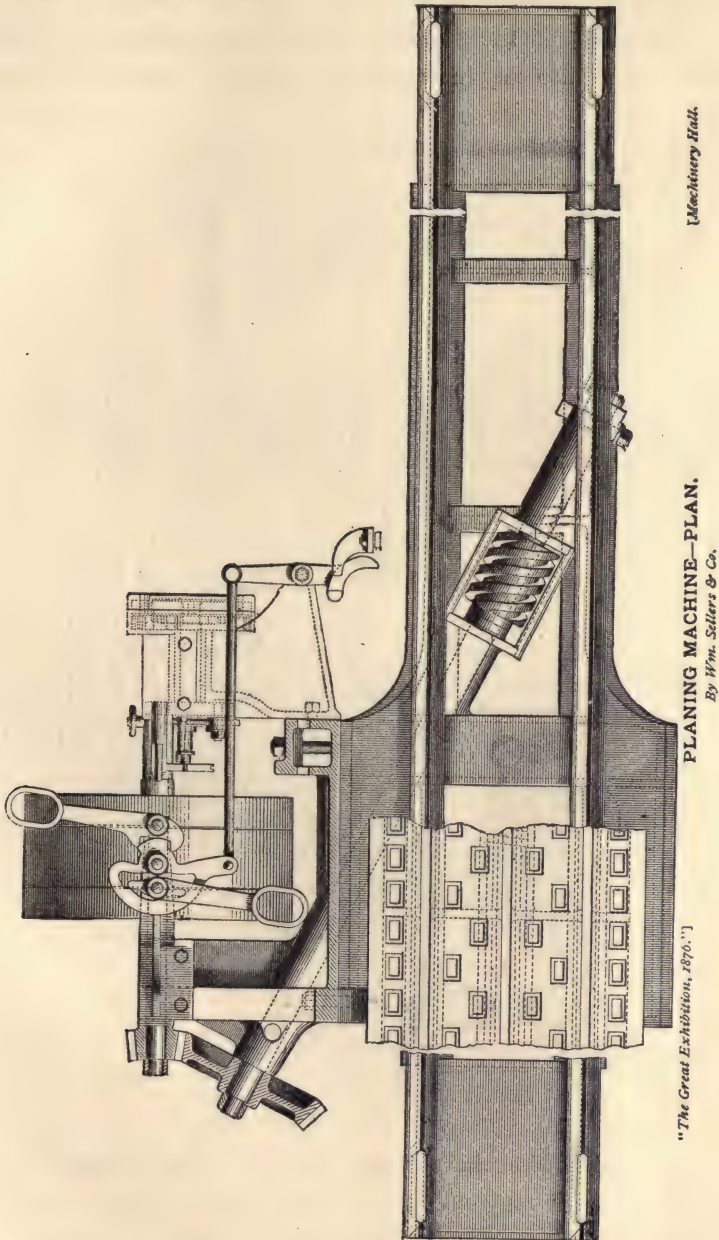
"The Great Exhibition, 1876."

PLANING MACHINE.
By Wm. Sellers & Co.

[Machinery Hall.]

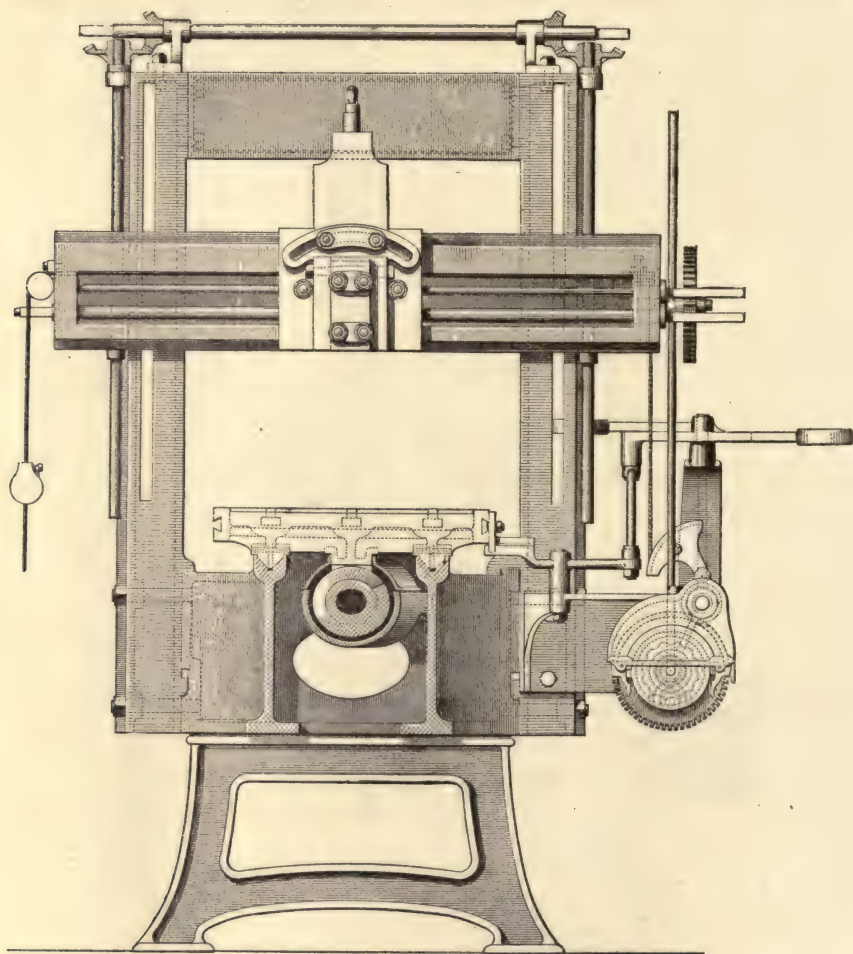
recessed into the saddle, around the central part containing the small feed bevels. In a spiral groove on the face of this plate-wheel slides a block which is attached to the end of a pipe surrounding the vertical feed-screw, and extending upward through the casting, with a pair of elastic clamps at its upper end. These clamps operate by friction on a flat rod which passes the whole length of the vertical slide on its side next to the saddle, and has at its lower end, which is thickened up, a hole. The long arm of a bell-crank lever fits loosely into this hole, and the short arm extends

down directly behind the tool-apron. The action of the cord



imparts motion to this bell-crank and affects the tool apron, pushing

it forward and letting it fall back again into place as required. The action is perfect and beautiful, without interference with any of the functions of the machine in the least. When the vertical slide is turned into any new position upon the horizontal axis of

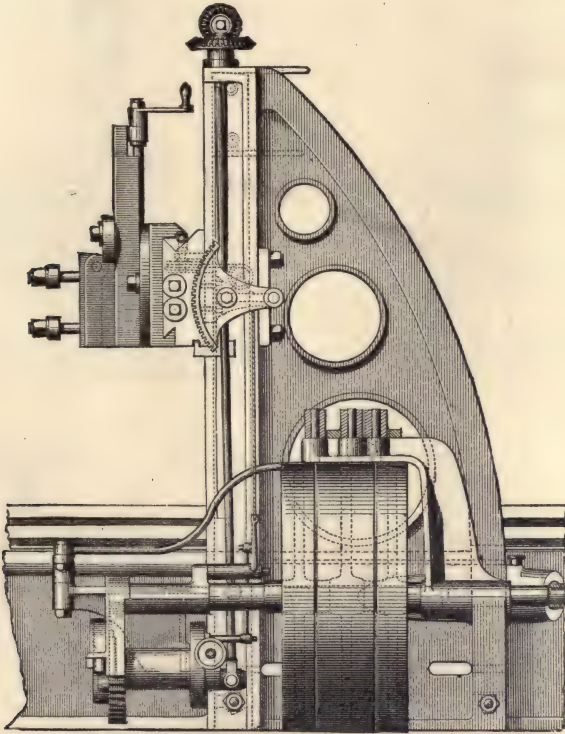


SECTION OF PLANING MACHINE.

By Wm. Sellers & Co.

the saddle, the pin in the spiral slot drags the plate-wheel around, the cord-wheel slipping within its encircling cord, and as soon as the machine is started adjustment to the new position takes place at once among the parts, the lifting apparatus operating as before.

Among the motors exhibited in the Machinery Hall, Langen & Otto's Patent Atmospheric Gas Engine, in the German Department, is a remarkably ingenious and exceedingly useful and effective machine, applicable with advantage in many cases in the industrial arts, more than three thousand being now in use on the Continent of Europe, working with considerable economy and effect.

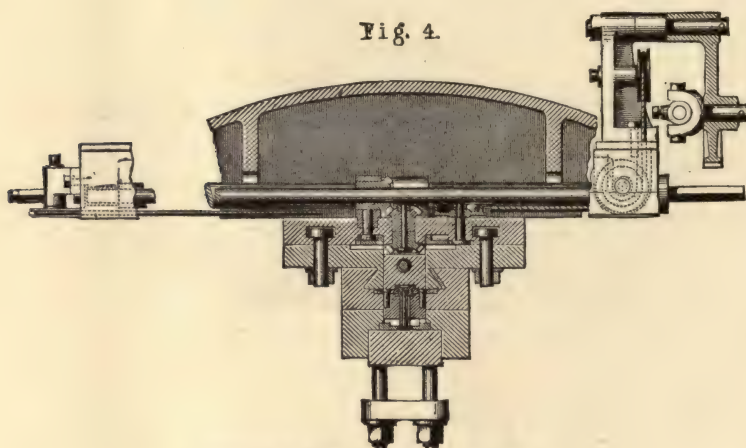
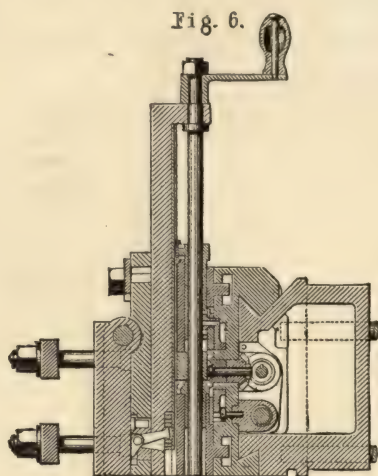
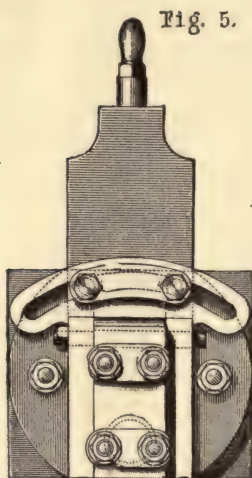


PLANING MACHINE—SIDE ELEVATION.

By Wm. Sellers & Co.

In all gas-engines, as previously designed, the motive power has been obtained by the direct action of the force of the explosion of a mixture of gases on the surface of the piston, in a similar manner to that in which steam acts in the steam-engine. In this engine the main characteristic may be said to be the use of a "free piston," rising without resistance upon explosion, the motive power being obtained indirectly during its descent by the pressure of the

atmosphere acting upon its upper surface, owing to the partial vacuum below, following the explosion. Great advantage obtains from this arrangement in furnishing a power of longer application, less suddenly exerted and more steady in its action. In former



DETAILS OF PLANING MACHINE.

By Wm. Sellers & Co.

machines the sudden, intense force necessarily given out could not be immediately made available, resulting in destructive action on the machinery of the engine and in great loss of power, which expended itself in heat, requiring a large application of water

to keep the parts cool, and avoid oxidization of the lubricant and destruction of the piston. All this could be accomplished, but the consumption of water was great and the heat taken up

Fig 12.

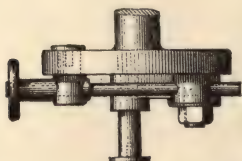


Fig 13.

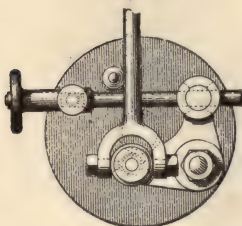


Fig. 14.

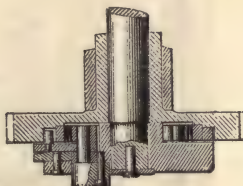


Fig. 10.



Fig. 11.

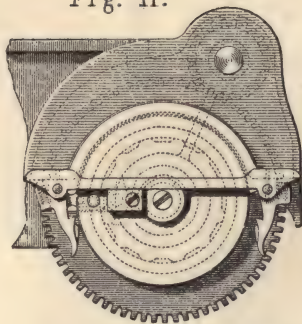
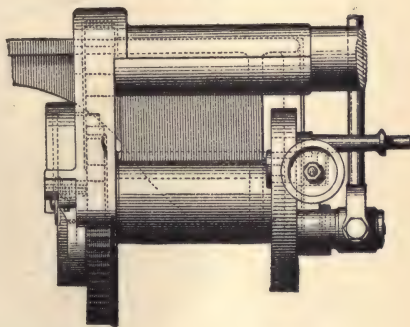


Fig. 9.



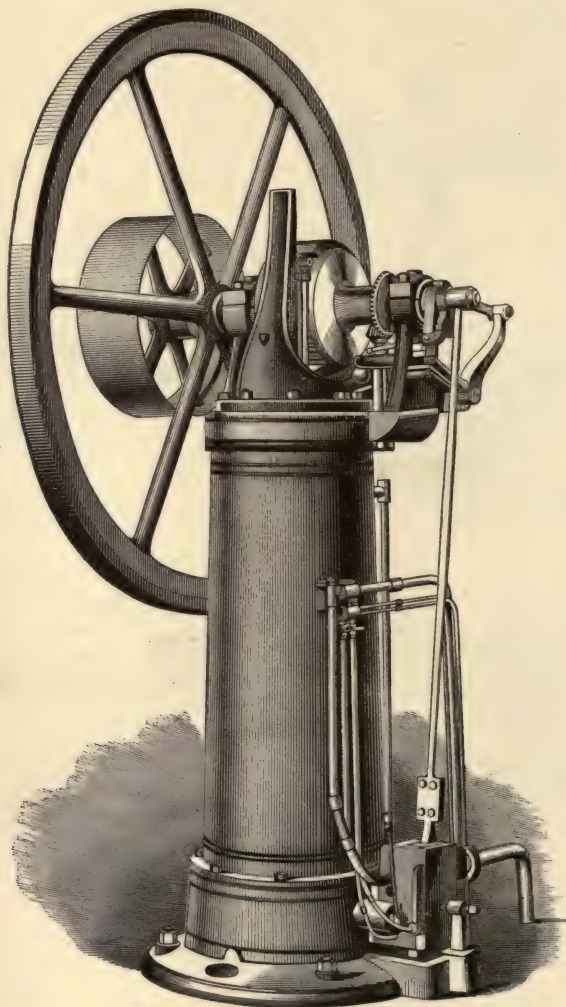
DETAILS OF PLANING MACHINE.

By Wm. Sellers & Co.

by it was carried off without doing work, amounting to just so much power lost.

The present engine—as shown by the perspective—consists of a large vertical piston-cylinder, having on one side, near the bottom, a valve-system for the admission and ignition of the mixed gases, and at the top a fly-wheel and the necessary mechanism

for utilizing the force from the piston and for working the valves below. Fig. 1 gives a cross-section at the base, showing the



"The Great Exhibition, 1876."

ATMOSPHERIC GAS ENGINE.

[Machinery Hall.

By Langen & Otto.

valve arrangement, and Fig. 2 a partly sectional detail of the mechanism at the top.

The most novel part of the design consists in the method adopted by which the piston is allowed to move freely upward,

but must connect with the fly-wheel as it returns downward. The piston-rod is a rack, and gears into a toothed wheel, shown in Fig. 2, which consists of a central pulley, *a*, keyed on to the shaft of the fly-wheel and surrounded by a toothed ring, *b*, on the interior face of which three inclined surfaces are cut. Between each of these and a corresponding curved wedge, *c*, faced on the side next to the pulley with leather, a set of live rollers—made of rubber—travels freely. On the upward motion of the piston, the toothed ring is free and revolves backward upon its central pulley; but upon the return stroke, the live rollers wedge in between the ring and pulley, giving a firm hold on the shaft and allowing the piston to impart its motion to it. One might suppose that ratchet-wheel and pawl would accomplish this result better, but it was found too sudden and rigid in its action and on trial abandoned.

To start the engine the piston is lifted up about one-eleventh of its stroke, causing a proper mixture of gas and air to be drawn in under it by the passage *x, x*, Fig. 1, and at the same time, by the motion of the valve, the chamber, *y*, filled with gas and air, goes first downward, igniting its contents by a flame, *w*, continually burning outside, and then upward to *x*, where it fires the charge under the piston. The resulting expansion drives the piston up very rapidly, reducing the temperature of the gaseous contents of the cylinder, consuming the heat in work, and the result is a partial vacuum under the piston which, by the pressure of the atmosphere, then makes a return stroke. The atmosphere is prevented from entering the lower part of the cylinder from the outside and destroying the vacuum; but a valve is provided that allows the products of combustion to be expelled by the piston as it reaches the bottom. The pawl, *d*, Fig. 2, in gear with the ratchet-wheel, *e*, on the main shaft gives the proper valve-motion. This pawl is controlled by an ordinary governor, worked by bevel-gearing from the fly-wheel shaft, and when the engine is running at full speed, a lever connected with this governor holds the pawl away from the ratchet-wheel, *e*, and no motion of the piston

takes place. As soon as the speed decreases in the least, however, the action of the governor releases the pawl, which makes connection with the ratchet, and, causing one turn, operates the valve rod, and, at the same moment, by means of the mechanism, *i, k, l, m, n*, raises the piston-rod far enough from the bottom to receive the charge of mixed gases; the explosion follows and the piston rises, repeating its operation as before. It will be seen

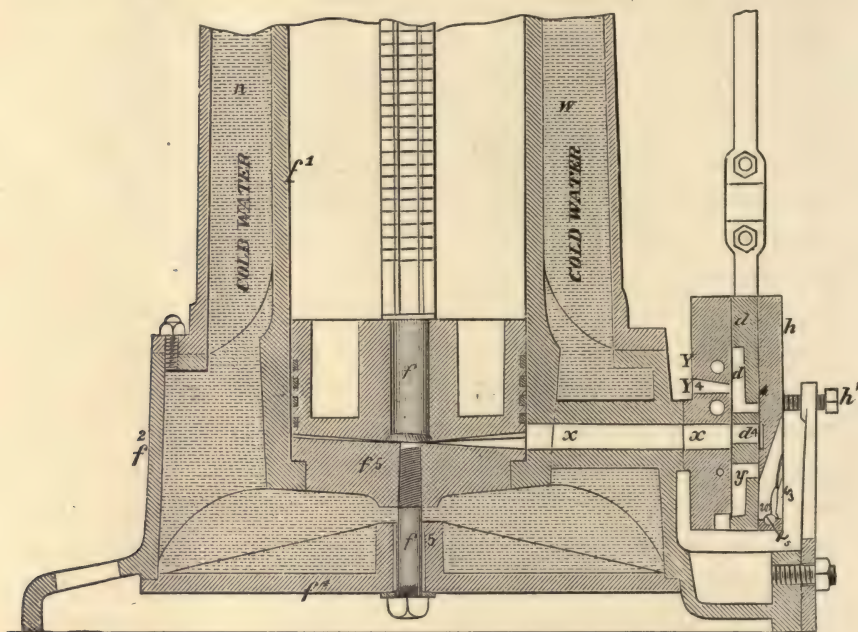


FIG. 1. ATMOSPHERIC GAS ENGINE.

By Langen & Otto.

by this that the piston does not necessarily act at every revolution of the driver, unless the full capacity of the engine is used, but only works when required to keep up the power. The driving-wheel may make even forty or more revolutions without any motion of the piston, unless the falling of the governor brings it into action. The economical effect of this is at once apparent, as the consumption of gas becomes directly proportional to the amount of work done.

The driving pressure on the return stroke varies from eleven pounds per square inch at first to nothing, at about four-fifths of

the stroke; or, say, a mean effective pressure of about seven pounds per square inch through the entire movement. The parties claim a consumption of gas of 26.5 cubic feet per horse-power per hour, and about 12 per cent. effective power on the theoretical amount supplied by the fuel.

The engines make a slight noise in working,—an inherent feature in machines of this kind,—but there are undoubtedly decided advantages in economy of fuel, cleanliness, absolute safety from accident by explosion, and capability of starting at full power at a moment's notice, making these machines formidable rivals of steam-engine in the limited sphere for which they are adapted. Messrs. Schleicher Bros., of Philadelphia, represent the exhibitors of the Gas-Engine and have made arrangements to manufacture it in the United States.

Greater prominence has been given to the Machinery Department of this exhibition than has ever been the case before, and a building has been erected which has been pronounced by those most competent to judge as the best ever provided for the purposes intended. In the centre of this building stands that wonder of the modern era, that thing which needs but the breath of life—what no human being has yet been able to invent, but must always supply by himself—to be a creation; that invention upon which now depends the daily bread of hundreds of thousands of people; a grand and noble specimen of the "Steam Engine." There it stands, holding its place as a veritable king among machinery, so powerful and yet so gentle, capable of producing the most ponderous blows upon the anvil, or of weaving the most delicate fabrics; that to which all other machines must be subservient, and without whose labor our efforts would be small indeed; the breathing pulse, the soul of the machinery exhibition. This engine, which may be seen from all parts of the building towering up above everything else, comes from little Rhode Island, from the city of Providence, and for its existence the Exhibition is indebted to the energy and perseverance of Mr. George H. Corliss, proprietor of the Corliss Steam Engine Company.

Early in 1875, when the question came up of the power that would be required in the building to run the fourteen acres of machinery which it was expected would be on exhibition, Mr. George H. Corliss, Centennial Commissioner from Rhode Island,

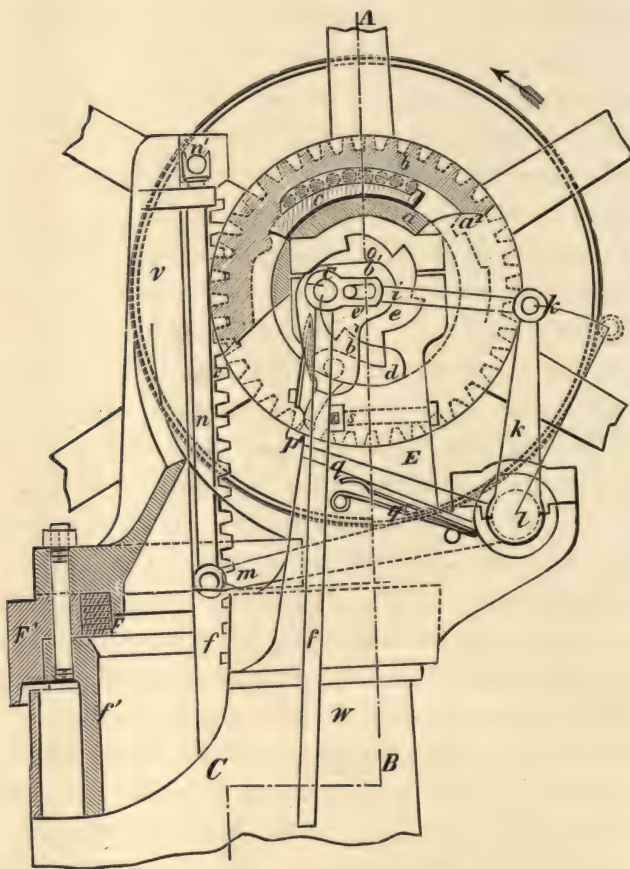


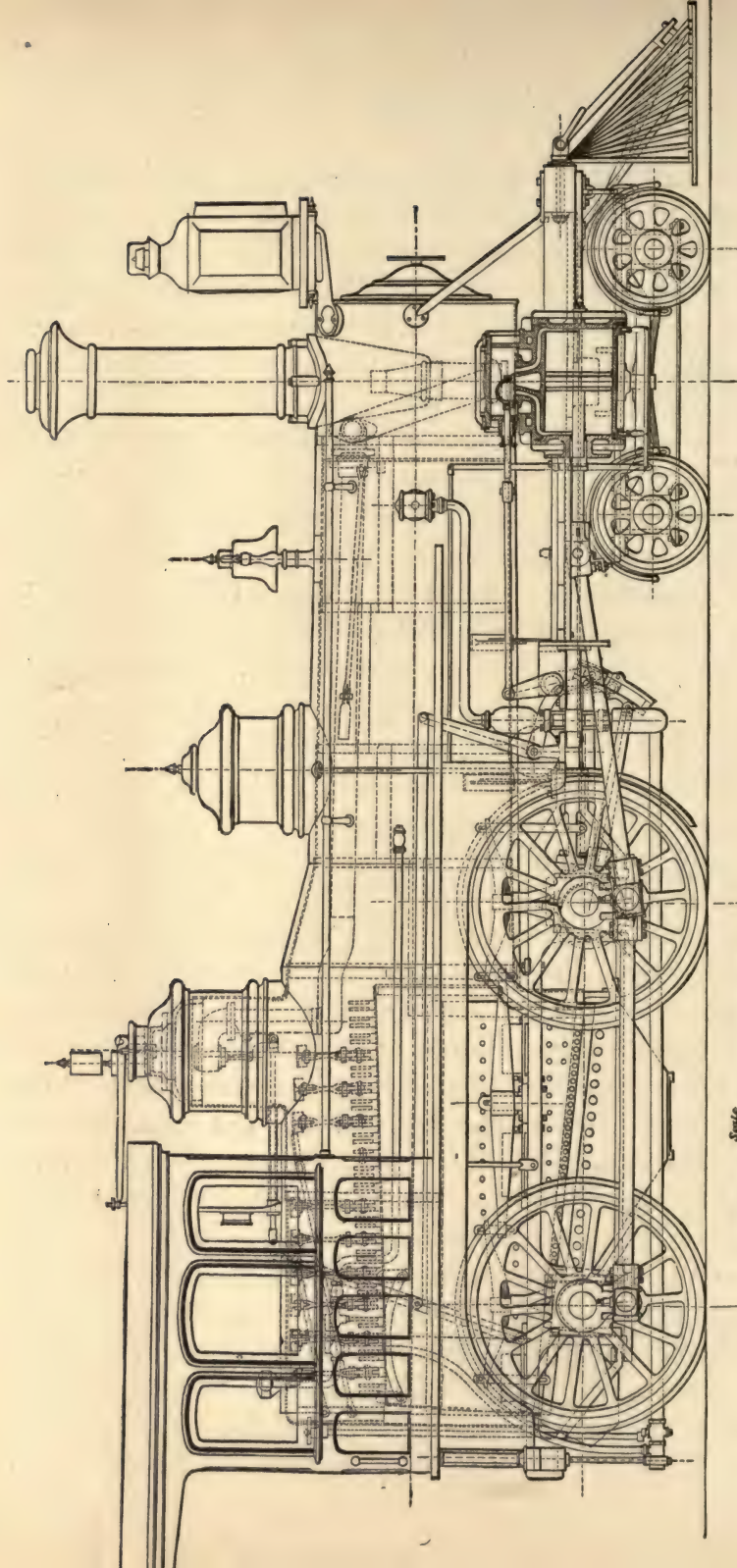
FIG. 2. ATMOSPHERIC GAS ENGINE.

By Langen & Otto.

conceived the idea of providing a single engine that should furnish this power—estimated at 1400 horses—placing it in the centre of the Machinery Hall, and he made an offer to the Commission to this effect. The Commission feeling that the honor of supplying this power should be distributed among different establishments,

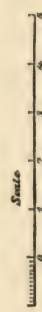
did not accept the offer, but invited proposals from prominent firms for what would be necessary to operate either the whole of the shafting in the building, or each line of shafting separately, so that it might be distributed among as many different parties as there were lines of shafting. When the proposals were received, it was discovered that they were not sufficient altogether to cover the requirements of the exhibition, that none of the bidders would agree to furnish the whole of the power, and that none would provide the boilers and connections necessary for the complete execution of the work. It was also found that the cost to the Commission would be much more than by Mr. Corliss' proposition. After considerable delay, Mr. Corliss was then unanimously requested to renew his offer, and in June, 1875, eleven months before the opening, a contract was closed with him for the work, giving him only ten months to construct that for which there had not as yet been even the first sketch prepared. How promptly the work has been performed, will be apparent when we state that on the day fixed by the contract—April 17, 1876—the engine was up in place, steam was turned on, and it was run for some time with perfect success.

The special characteristics of the Corliss Engine as compared with other steam engines may be said to consist in the valve gear, the form of valve and the peculiar method adopted by which steam is freely admitted at the full boiler pressure and discharged after use, without presenting any resistance to the piston. Independent parts are used for admitting and exhausting the steam with four separate valves, the steam being cut off from the cylinder entirely by the main steam valves without the employment of any supplementary valves. The steam valves are opened against the resistance of springs, and a liberating gear is called into play, disconnecting the valves and leaving them free to be closed by the springs. These springs are brought to rest without shock after closing by means of an air cushion formed by a small cylinder with a closed bottom, in which a piston is fitted to work easily, a certain amount of air being imprisoned just as this piston



[Machinery Hall.]

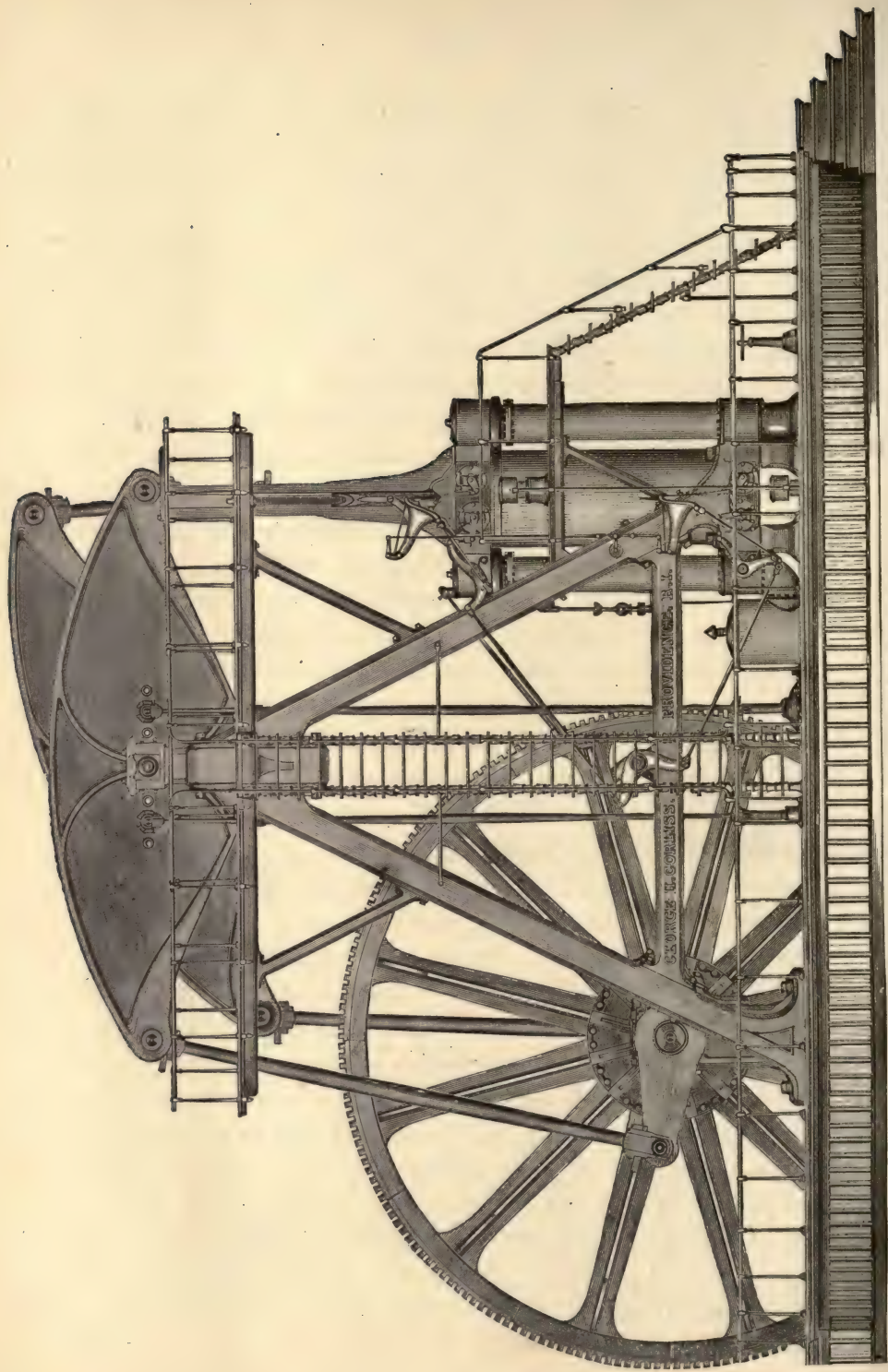
PASSENGER LOCOMOTIVE.
By Burnham, Parry, Williams & Co.



["The Great Exhibition, 1876."]

approaches the bottom, acting as a cushion and preventing any shock. The valves of admission are regulated by direct connection with the governor, thus controlling the speed of the engine without the use of a throttle-valve in the main supply-pipe.

In reference to the special points which distinguish this particular engine, it may be said to be a strictly engineering design, the material of the framework being arranged directly on the constructive lines so as to best resist the action of the forces which come upon it at the least waste and expense. The forms of the lines of curvature of the walking-beams are important in considering the effects of cooling in the castings, and the shape is that best adapted to resist the stresses to which they are exposed. The arrangements by which the keys of the connecting-rods are accessible in any position of the beams, and the cutting away of the lower portions of the beams, making the lower lines different from the upper, are all noticeable. In fact, every detail of the design has been made with a view to the strength, symmetry and accessibility of the parts. The valve-gearing is a very novel and characteristic feature, all the peculiarities having been emphasized and carried to greater perfection than in any previous engine manufactured by the company. The crank-pins are covered with a coating of the best steel, hardened and ground as smooth as glass, and all work on the machine has been carried out with equal thoroughness. The engine is really a double engine formed of two large beam engines of 700 horse-power each, set upon a raised platform fifty-five feet in diameter, and having between them a single fly-wheel (a gear), the cranks of both connecting with the same crank-shaft. Although possessing nominally 1400 horse-power, it may be increased, if found necessary, to 2500 actual horse-power. The cylinders are 40 inches in diameter, and the stroke is 10 feet, the intention being to work with from twenty-five to eighty pounds of steam, according to the requirements of the Exhibition. An engine at the Wamsutta Mills, New Bedford, has a larger cylinder, but it is not so heavy an engine, and will not stand so high a pressure or do as much work as



THE CORLISS ENGINE.

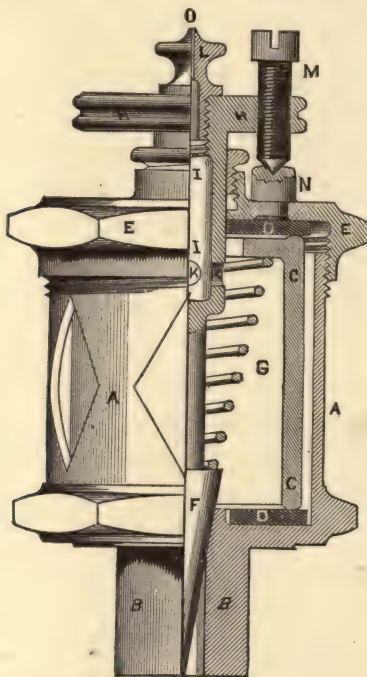
"The Great Exhibition, 1876."

[Machinery Hall.]

this one. The air-pump and condensing apparatus are fully provided as required. The gear fly-wheel, which is 30 feet in diameter, and cast in sections, weighs about 56 tons, and is believed to be the heaviest cut wheel ever made. It has two hundred and sixteen teeth, finished with the greatest accuracy, moving without noise at the required rate of running, viz., thirty-six revolutions per minute. The crank-shaft is 19 inches in diameter and 12 feet long, made of the best hammered iron, and the bearings are 18 inches in diameter and 27 inches long. The cranks are of gun-metal, weighing over 3 tons each. The walking-beams—which weigh about 11 tons each—are cast in one piece, and are 9 feet wide in the centre and 27 feet long. The connecting-rods are of horse-shoe scrap-iron, and the piston-rods, $6\frac{1}{4}$ inches in diameter are of steel, their velocity at the regular rate of speed being 720 feet per minute. The large gear-wheel, connecting with the gear fly-wheel, is 10 feet in diameter, and is a single casting of 17,000 pounds weight. It is placed on a main shaft 252 feet in length, running crosswise of the building, and connecting at the ends and at two intermediate points by nests of bevelled gear 6 feet in diameter to shafts 108 feet in length, running at right-angles to the main shaft, and extending to points directly under the lines of overhead machinery shafting. These four connecting shafts have at their ends the main pulleys—eight in all—seven of them 8 and one 9 feet in diameter, and each 32 inches across the face. They are connected to the main machinery shafting overhead by double belting 30 inches in width, making an aggregate width for all together of 20 feet, required for the transmission of the whole power of the engine. Each belt drives a line of shafting of over 600 feet in length, with a separate section of the machinery, and where the belts rise from the floor, they are enclosed by glass partitions so that they may be out of the way and yet be visible to the visitor as exhibits.

The engine as a whole is 39 feet in height from the main floor of building to top of walking-beam at its highest pitch, and every part is easily accessible by means of balconies and stairways.

Its total weight, including everything connected with it, is about 680 tons. The general proportions are exceedingly harmonious and graceful, and the details simple and in excellent taste, the frame-work, walking-beams, balconies, etc., being painted of a quiet, uniform tint, relieved only by the polished work of the cylinders and moving parts.



"The Great Exhibition, 1876.")

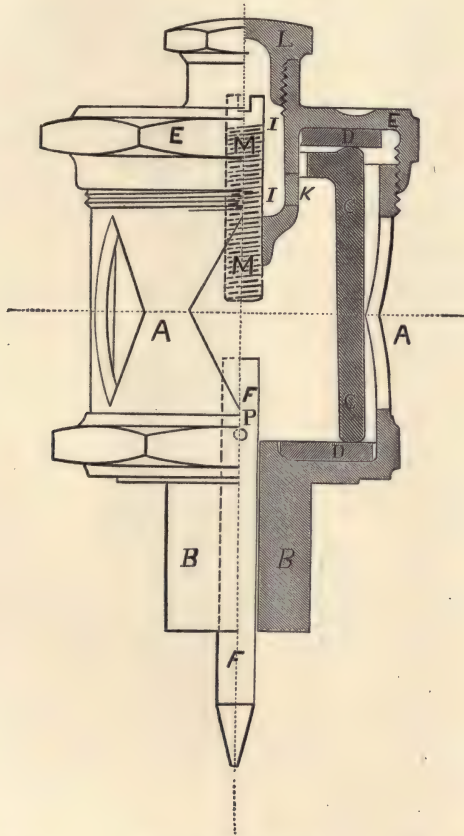
FIG. 1. OIL-CUP.

By Loneragan.

[Machinery Hall.

The boiler-house—just south of Machinery Hall—contains twenty Corliss upright boilers of 70 horse-power each, of a simple, vertical tubular type, entirely accessible inside and out. The water rising very rapidly around the tubes in the central part of the boiler is provided with a large return space next to the outside where the current moving more slowly allows an opportunity for the deposit of sediment, which may readily be removed. At the top, each tube is easily reached for cleaning when required. Horizontal flues, lined with fire-brick connect with two brick

chimneys, and the steam is conveyed to the engine by means of a double-riveted wrought-iron pipe 18 inches in diameter and 320 feet long, well protected with felting to retain the heat of the steam, and carried through an underground passage, lighted by gas, and sufficiently large for a man to easily walk its whole length.



"The Great Exhibition, 1876."

FIG. 2. OIL-CUP.
By Lonergan.

[Machinery Hall.

Among the firms represented at the Centennial Exhibition none occupy greater prominence than Messrs. Burnham, Parry, Williams & Co., of the Baldwin Locomotive Works, Philadelphia.

Among the exhibits of this firm is a Passenger Locomotive built for the Central Railroad of New Jersey, and represented by

the engraving on page 364. It has a gauge of road of 4 feet 8½ inches and a total wheel-base of 44 feet 2 inches, including tender, or of locomotive alone, 22 feet 5 inches. The driving-wheels are 8 feet 6 inches to centres and 5 feet 2 inches in diameter, having centres of cast-iron with hollow spokes and rims. The truck-wheels are 2 feet 4 inches in diameter. The Washburn steel tires are used. The total weight of the locomotive in working order is 75,000 pounds, and the weight on driving-wheels 51,500 pounds. The cylinders are placed horizontally, each cylinder cast in one piece with half saddle, right- and left-hand cylinders, reversible and interchangeable, the diameter of cylinder being 1 foot 5 inches, and length of stroke 1 foot 10 inches. The oil-valves to cylinders are placed in the cab and connected to steam-chests by pipes running under jacket of boiler.

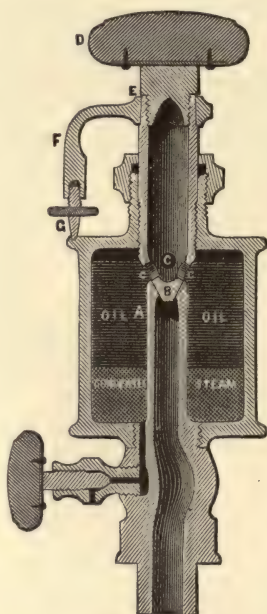


FIG. 3. OIL-CUP.
By Loneragan.

fourth and the back sheet five-sixteenths of an inch thick. The tubes are of iron, lap-welded, made by W. C. Allison & Sons, with copper ferrules on the fire-box ends. They are 2 inches in diameter, 11 feet 3 inches long and one hundred and sixty-three in number. The heating surface comprises 1065 square feet, including grate, fire-box and tubes.

The tender has eight wheels of 2 feet 6 inches diameter, furnished with Taylor's steel tires. The capacity of tank is 2200

The boiler is of the wagon-top type, furnished with one dome and made of best homogeneous cast-steel three-eighths of an inch thick, manufactured by Hussey, Wells & Co., the outside diameter at the smallest ring being 4 feet. The fire-box is of cast-steel of the same manufacture, 8 feet 6 inches long by 2 feet 9¾ inches wide, the side sheets being one-

gallons, the tank-iron being manufactured by the Catasauqua Manufacturing Company. The engine throughout is finished according to the high standard for which this firm is so celebrated—solid, substantial and neat, with no useless ornamentation, every part fitted to guages and thoroughly interchangeable, the whole being an excellent specimen of American manufacture.

In connection with the motive-power exhibits we may very appropriately mention Lonergan's Patent Oil-Cups and Automatic Lubricators. The principles upon which they work have been beautifully carried out, resulting in most excellent forms of apparatus for the requirements. The oil-cups are of several varieties to suit different purposes. Our first engraving, on page 368, shows the usual construction for stationary motion, being partly in section and partly an exterior view.

It consists of a metallic cup or casing, A, A, pierced by diamond-shaped openings in the cylindrical part, with a tube, B, to be connected with, and passing to, the part to be lubricated. Inside of this casing is a glass cylinder, C, with cork rings, D, D, at top and bottom. The cap, E, screws down tightly on to the cork, making an oil-tight joint. A plug, F, with ground joint, and held in place by a spiral spring, G, effectually closes the tube B and prevents the passage of oil unless desired otherwise. This plug connects with the handle, H, H, on top, the connection being movable through the cap, E, of the casing and hollow in the upper portion as shown at I, I, there being openings, K, at the lower end of this hollow space, and a cap, L, screwed on at the top, the latter having an air-hole, O, pierced through it. A set screw, M, passes through the rim of the handle, H, with a rest, N, for the same in the cap, E. When it is desired to fill the cup, the cap, L, is unscrewed and the oil poured in, the handle, H, being turned around until the set-screw, M, is off of its rest, N, the plug, F, then tightly closing the entrance to the tube, B. After filling and replacing the cap, L, then by turning the handle, H, and placing the set-screw, M, on its rest, we can, by adjusting this screw, regulate exactly the required amount of opening neces-

sary at F for the proper oiling of the machine. When the machine is at rest and no oiling needed, it is only requisite to raise the handle, H, and turn it so as to move the set-screw from its rest, and the spring, G, at once closes the plug, F, into the opening of B, and stops the consumption of oil.

Figure 2 shows a modification adapted to movable parts under rotary motion. The spring, G, is dispensed with and the loose plug, F, has a little stop, P, in it, the set-screw, M, being differently arranged as shown. At each rotation the loose plug, F, is thrown up, the distance of its throw being regulated by the set-screw, and a certain amount of oil finds its way down the tube, B, B.

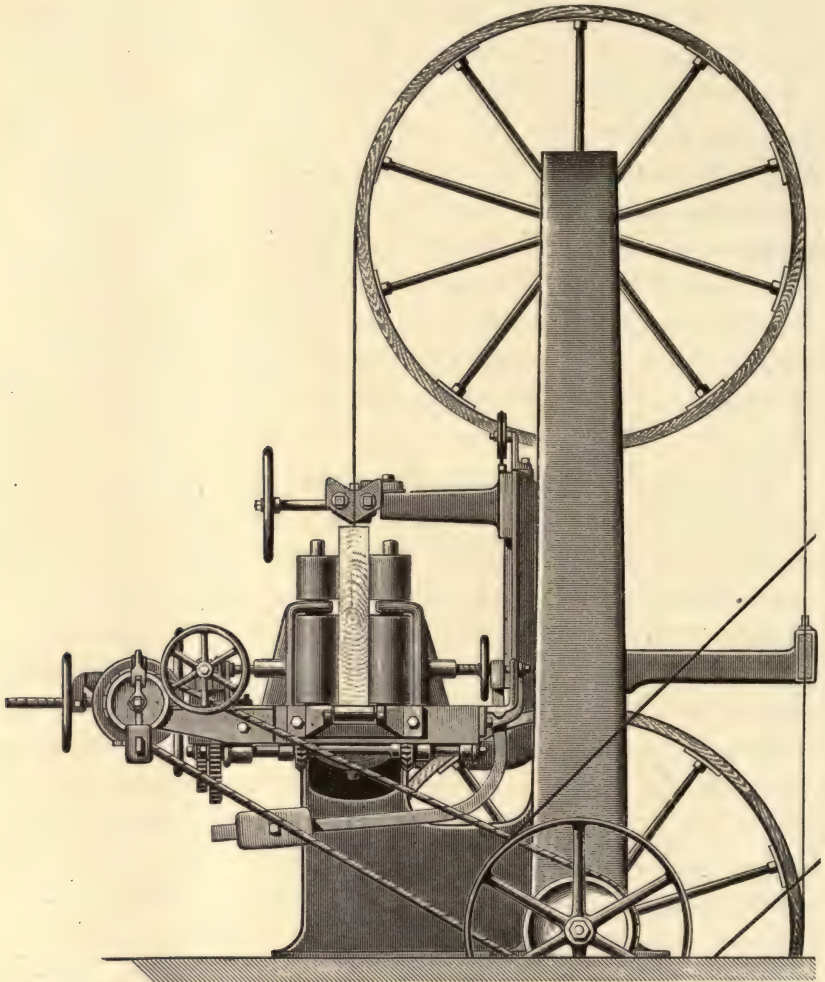
The Automatic Lubricator, as shown by Fig. 3, has a cup composed of the best quality steam metal and made extra heavy, with a regulating arm on top allowing adjustment to any feed desired, there being small holes or rests for the end of the jam-screw of this arm at short intervals all around the circumference of the cap of cup. In arranging it for use, the valve, B, is closed and the cup filled with lubricant through the stem, E. The top, D, which has a *lignum-vitæ* handle to prevent heating, is then screwed down tight, and the valve, B, opened by turning the handle until the indicator or arm is half-way around the cup. After a moment it is moved partly back to within say six or eight holes from the starting-point. By actual experience, the engineer can adjust this to the exact requirements of his engine. Steam passes into the cup by the valve, B, and condensing into water sinks to the bottom of the oil, lifting an equal amount of the latter to the top, which flows down the pipe to the parts where lubrication is desired. The large opening in the pipe to the top of the feed-valve allows a circulation of steam, keeping the lubricant in a liquid state independent of outside temperature and securing thereby a uniform feed. A waste-cock is provided for drawing off the condensed water and impurities which collect in the bottom of the cup.

Messrs. Richards, London & Kelley, of Philadelphia, and London, England, make a fine exhibit of machinery for working

in wood, from which we select one of their Band Sawing Machines, the front and side elevations of which are shown by the engravings on pages 374 and 376. The machine is very substantially constructed, the frame being of cast-iron in one piece, with a rectangular cored section. The wheels are sixty inches in diameter, made of wrought iron covered on the circumference with wood faced with leather or gum, and are warranted to stand the tension of blades up to three inches in width, and resist safely any centrifugal strain. A vertical adjustment of sixteen inches is provided to the top wheel, which is carried on a steel shaft two and a half inches in diameter, with bearings on both sides of the wheel, and saws may be used up to thirty-two feet in length and three inches in width. The supports of the shaft rest on springs, which equalize the tension on the blades, allowing them to expand and contract freely.

The machine has feed-rolls adapted to take timber of twenty-four inches in width and ten inches in thickness, or to cut from one side of a plank five inches thick. The method of imparting motion to the feed-rolls is novel and very superior, being accomplished as follows: A revolving plate with its axis at right angles to the feed-shaft comes into rolling contact with the circumference of a wheel on the feed-shaft, which slides on a spline of the shaft, and may be moved to and fro each way from the centre of the revolving-plate. The action of the revolving-plate causes this wheel to turn with greater or less rapidity, depending upon its distance from the centre, and its movement operates the feed, the speed of which is regulated accordingly. The feed will be either forward or backward, depending on which side of the centre of the revolving-plate the wheel is placed, and the direction can be changed at a moment's notice. The power being frictional makes it a safeguard against breakage, and at the same time it is sufficiently tractive for all practical purposes. Attempts have been made previously to use feeding appliances of this kind in moulding and other machines, but the conditions were for some strange reason always reversed and the result was a failure. The arrangement

here adopted seems to accomplish all that is wanted, and the rate of feed may be increased from zero to forty feet per minute



"The Great Exhibition, 1876."

BAND SAWING MACHINE.
By Richards, London & Kelley, Philadelphia.

[Machinery Hall.

or the reverse, the feed being started or stopped at pleasure, and made either forward or backward.

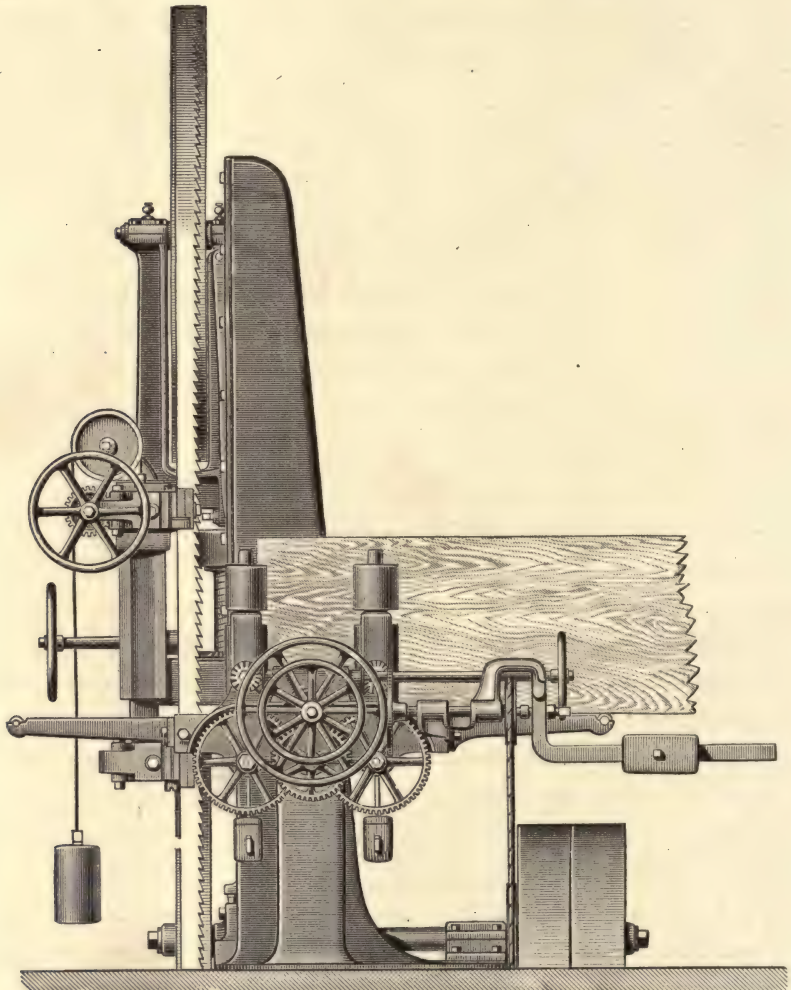
The saws used are those of M. M. Perin & Co., of Paris, France. Band saws were invented nearly seventy years ago, William

Newberry, of the city of London, England, having in 1808 constructed and patented a band sawing machine, which, judging from the illustrations preserved of it, appears to have been a very good machine, possessing nearly all the capabilities of those of the present time. The pivotal table, the parallel guage, the feeding rolls, and radius link were all provided, the great material difference being the inconvenient manner of removing and replacing the blades. Circular saws were hardly in use at that time, and the opportunity would seem to have been exceedingly good for competition against the reciprocating saws of the day. Little or no use was made of the invention, however, and it lay dormant until within the last twenty years, when the subject again came forward, and saws of this kind were first exhibited as a novelty at the Paris Exhibition of 1855. The cause of this is believed to have been due to the difficulty experienced in the manufacture and joining of the blades, which could not be made to stand the flexion and strain to which they were submitted in working, and it was not until M. Perin, of Paris, undertook the manufacture of blades some twenty-five years ago, and by perseverance triumphed over every difficulty, that the success of the band saw was achieved.

The blade is the principal part of the machine and the only part from which difficulties arise in its operation. France has had the monopoly of the manufacture of saw-blades, and will probably keep it for a long time, unless some of our American firms come forward and spend the money and time on experiment, and bestow that care and attention on the work which have produced their results in France, trusting not to any present remuneration, but rather to what may come in future years. The impetus given to the manufacture by the efforts of M. Perin, the special knowledge requisite, much of it kept secret; the tedious hammering process required, necessitating skilled labor, which may be obtained at so much less cost in France than elsewhere, and many other reasons have all combined to give her the supremacy.

There are various causes for the breaking of saws, such as crystallization, extreme or irregular tension, heat generated by

friction on the guides, or careless use. It is well known to all those interested in such matters that a certain temper is requisite in deflecting steel springs, and that if this temper is obtained



"The Great Exhibition, 1876."]

BAND SAWING MACHINE.

[Machinery Hall.

By Richards, London & Kelley, Philadelphia.

they will last for years or for a life-time. When one remembers, then, how difficult it is to obtain this temper, even with short springs like those in gunlocks, it is easy to conceive the almost insuperable difficulties in the way of obtaining this temper with

bands of steel twenty to thirty feet in length; and the least variation in this temper for even an inch in the length of the saw destroys the value of the blade. In addition to this, as if to increase still further the difficulties already quite sufficient, there appears to be no reliable method for ascertaining in a finished blade if the quality and uniformity of the temper are correct. The buyer must depend on the good faith of the manufacturer, the value of the saw depending not on its appearance, but on the care with which it has been made and the perfection of the processes used; and the blade should be completely finished ready for use by one firm, so that what may leave the hands of one party in good condition may not be spoiled by the bad work of another.

Thousands of Band Saw Machines are now in use, and occupying the high position that they do in reference to economy of both labor and material, they may well be classed among the prominent machines of the day.

In connection with the subject of band saws we would draw attention to an exceedingly effective "Band Saw Setting Machine" on exhibition and manufactured by the same firm under the patent of Mr. L. O. Orton, the inventor. This machine is intended to accomplish two objects; to furnish a method of rapidly and accurately setting saw teeth and to do so by impact or blows just as would be done by a hand hammer, thus giving a permanent set to the teeth without liability to change as when set by springing or bending. The illustration on page 378 shows the machine and its method of working, the saw being held in a filing frame, such as usually employed, to which is attached the setting device which is to all intents and purposes really a hammer in the hands of the operator. The frame is formed of two rails or bars connected by cross rails on which are wheels, which receive and stretch the saw blade in position. The setting mechanism consists of a pivoted swinging frame carrying two dies or hammers so arranged that when the operator by means of a handle on top swings the frame back and forth, they will strike right and left, giving alternate blows against two die-blocks placed on opposite sides of the saw

teeth, the saw blade passing through a groove, and the alternate teeth coming under the hammer. By a simple mechanism a hook or pawl engages with the saw teeth and at each movement of the swinging frame draws the saw forward the distance of two teeth so that the teeth are brought automatically into the proper positions to be struck one pair after another. An adjustment is provided to regulate this movement of the saw in a moment to any pitch of teeth. Where a large



[Machinery Hall.]

BAND SAW SETTING MACHINE AND FILING FRAME.

By Richards, London & Killy.

"The Great Exhibition, 1876."

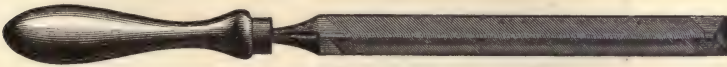
saws are under operation or where the teeth are far apart two pawls are used, one for each single swing, but with ordinary saws one pawl is sufficient and is preferred. The whole of the setting mechanism attached to the frame may slide to any part, or be secured if desired and used independently. The degree of force of the blows and the time in which they are given are in direct control of the operator, the action on the teeth being the same in effect, but more perfect than can

be attained by a hammer in the ordinary way. A filing vise is also attached to the frame, although it may be used independently, and is arranged with an improved clamping device consisting of two volute faces, one formed solid with the vise and the other with a handle, there being in this case with a long vise, three of



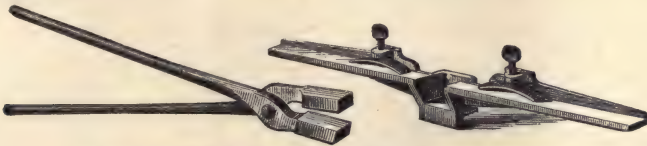
FILING VISE.

these with handles connected by links, and all actuated by one movement. By turning the handle right or left the jaws of the vise are instantly closed or released. A band saw file with round corners is recommended and used, giving a circular form to the



BAND SAW FILE.

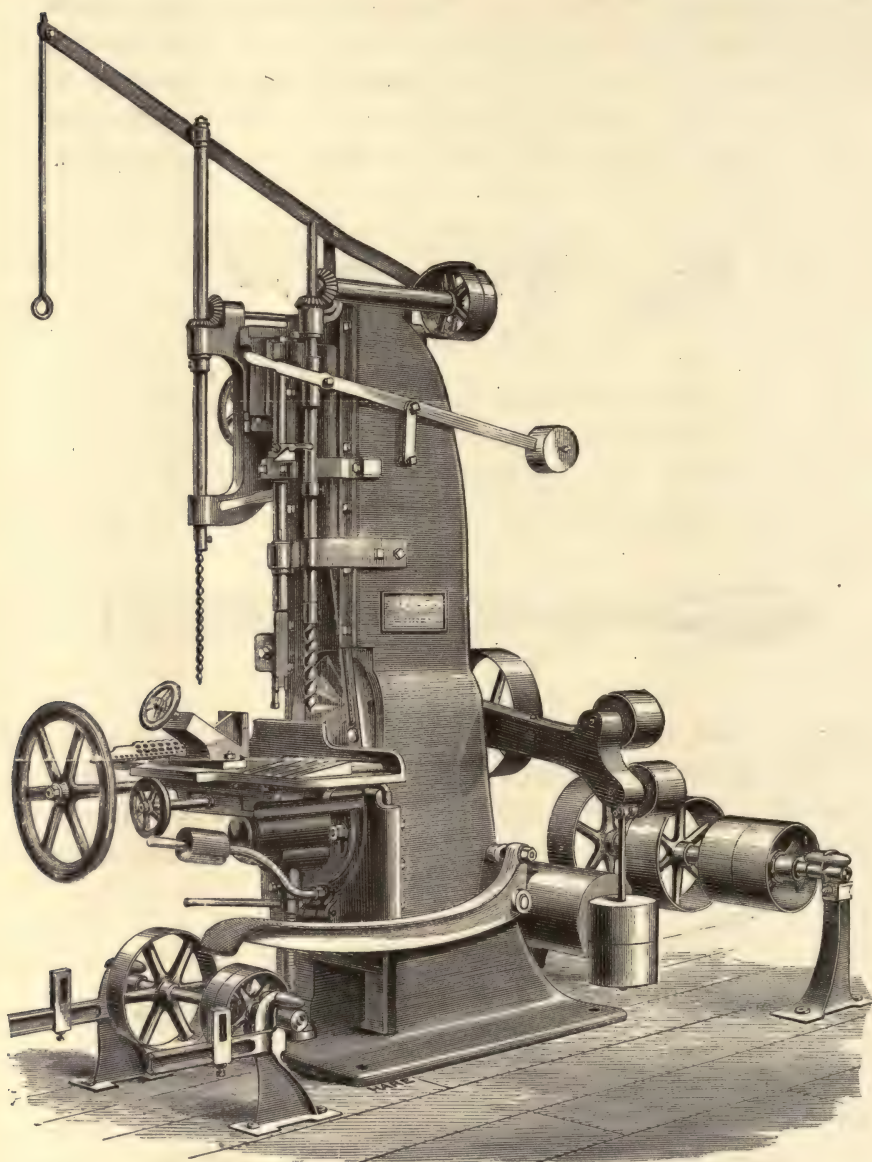
bottom of the spaces between the teeth and preventing fracture. A scarfing frame and tongs for soldering the two ends of a saw-blade together are also exhibited. The ends of the saw are first scarfed or tapered for a length of one to two teeth, depending



SOLDERING TONGS.

SCARFING FRAME.

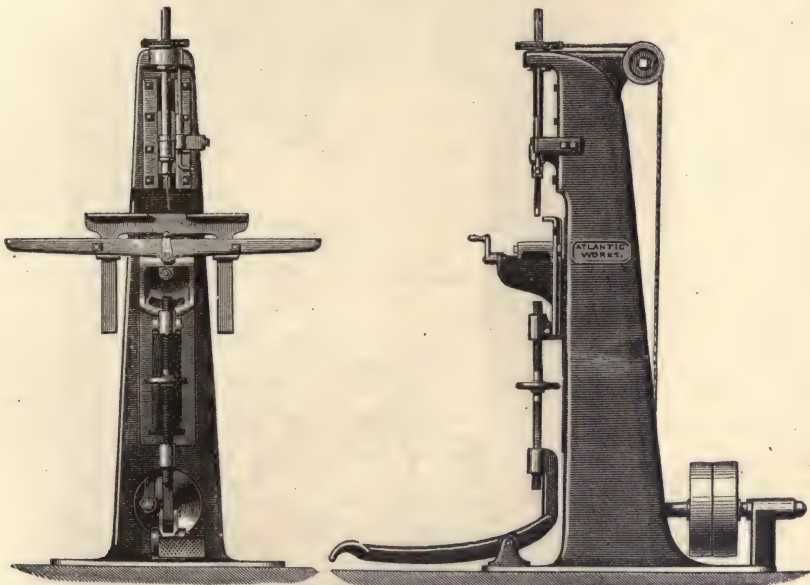
on the pitch, care being taken to make the scarfing true and level. The silver solder of the jewelers is generally used, rolled into thin strips so that a piece of the size of the lap can be cut off and laid between. The joints are cleansed with acid, the solder placed between and the whole then clasped with the tongs which must be at a full red heat. The tongs are removed as soon as the

**RECIPROCATING MORTISING MACHINE.**

By Richards, London & Kelley.

solder runs, and a wet sponge applied to restore the temper, the joint being afterwards filed up into proper shape

Messrs. Richards, London & Kelley, also exhibit a strong heavy "Reciprocating Mortising Machine," arranged for railway car and other similar work, which is deserving of notice. Motion in machinery may be divided into two classes, rotary and reciprocating, a few exceptional cases combining both motions. There are various difficulties arising in the employment of reciprocating motion that render its use objectionable wherever it can be avoided. These difficulties obtain especially in wood-working machinery on account

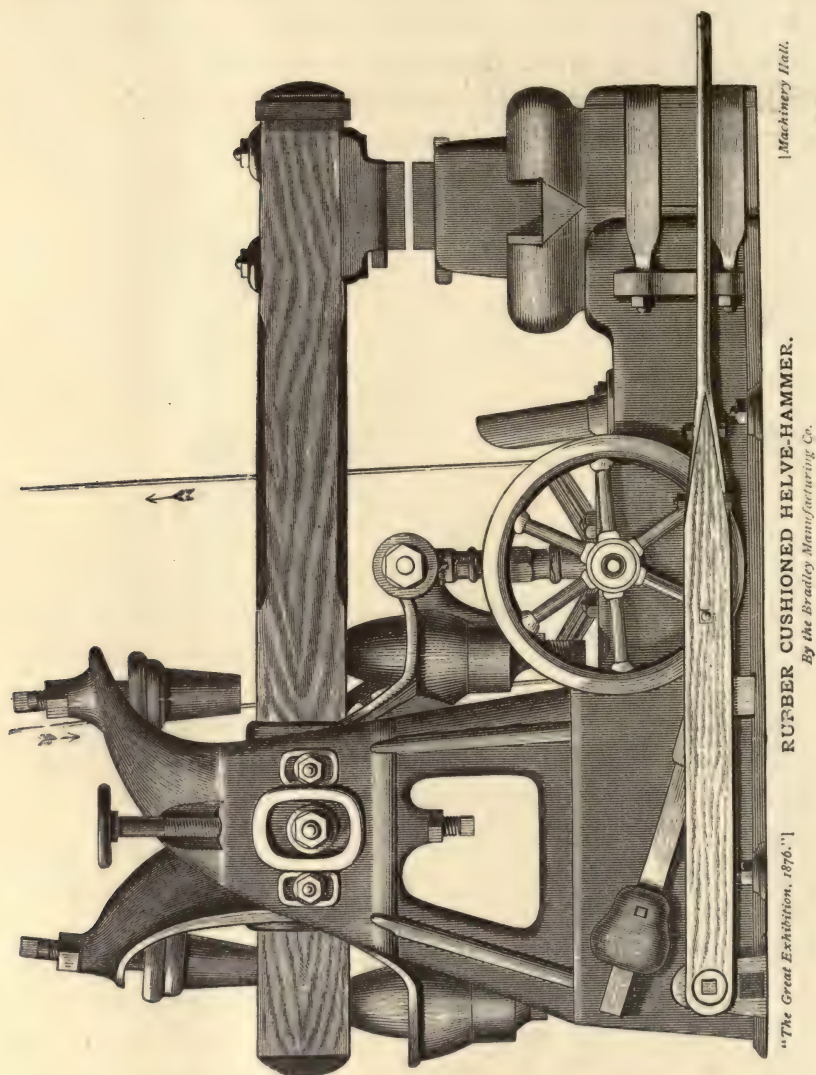


ELEVATIONS OF RECIPROCATING MORTISING MACHINE.

By Richards, London & Kelley.

of the speed at which it is necessary to work. In consequence rotary motion is every day coming more into use, and new applications being made of it. In England and France mortising is done almost entirely by rotary machines or by hand, but in this country reciprocating machines have been extensively used. The variety of designs from different makers give evidence of the imperfections encountered and the efforts constantly made to overcome them. The machine which we illustrate belongs to that class in which the reciprocating parts are all brought down towards

the timber operated on, the chisel having a continuous motion with a uniform range and a positive eccentric. Chisels of any width are received, and there are two boring spindles, one fixed



and the other to traverse twelve inches. The feed movement is actuated by a treadle and may be locked to prevent jarring the foot of the operator. All joints are compensating and operated

without noise. The distinctive feature of the machine consists in its being direct acting, and having the crank shaft not on top but near the bottom in the base of the column, the machine standing upon a foundation without top-bracing. The crank shaft, chisel bar and boring spindles are of steel.

We also give an illustration of another mortising machine exhibited by this same firm belonging to that modification in which the wood is moved up or fed to the chisel, the operating parts consisting of a crank shaft, a plain chisel bar and connection. It is well adapted for joiner and cabinet work, carriage work and general purposes, and is capable of being driven at a high rate of speed—four hundred to five hundred revolutions per minute, like the previous machine requiring no top bracing, the crank shaft being placed in the base near to the foundation, avoiding vibration and jar. The table is raised by a foot treadle to feed the lumber to the chisel which has a uniform stroke of five inches. The chisel is provided with the automatic reversing device of H. B. Smith, allowing it to be reversed by power with a friction band and at the same time holding the chisel bar firmly while in motion and preventing any possible deviation from its proper place owing to wear or loose joints. The escapement is performed by hand so that the chisel can be reversed at will, independent of the treadle. The table is made either as here shown or arranged to clamp the piece of timber to be mortised, and the whole moved by rack and pinion. The firm deserves credit for the manner in which it has endeavored to overcome as far as possible the inherent difficulties in this class of machines.

The trip- or helve-hammer approaches nearer to the hand-hammer in its action than any other mechanical agent of its class, and for this reason is better adapted to certain peculiar kinds of work. There have been various causes, however, operating against its use, one being the difficulty of making proper connection with the driving power. The sudden shocks which it produces on shafting in starting, the irregular motion and the varying power required, all prevent the use of rigid connections, necessitate the

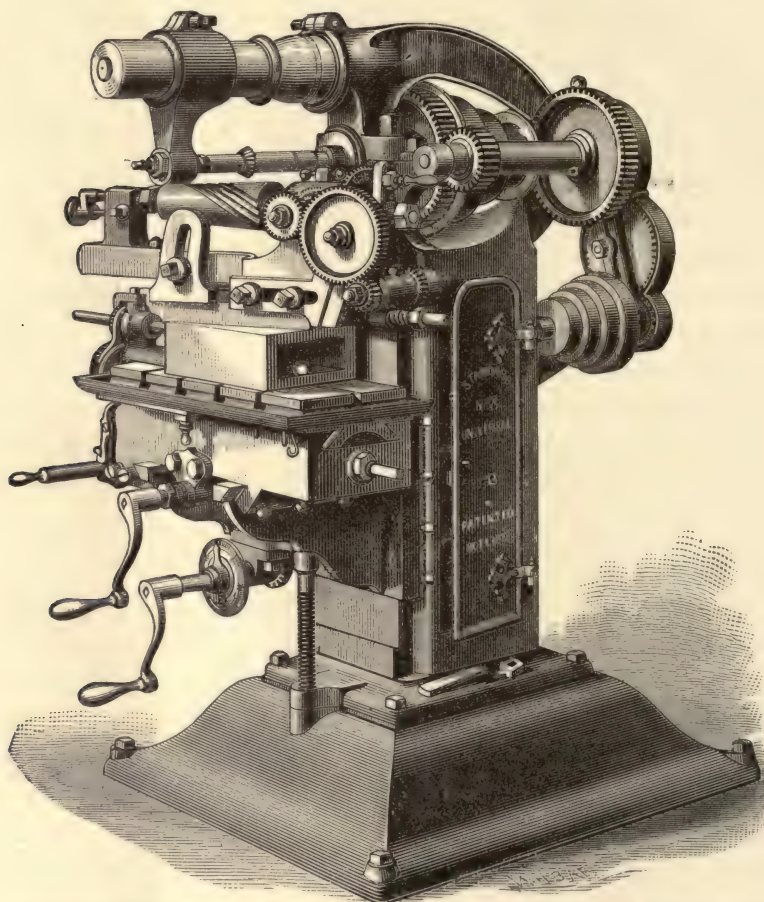
adaptation of slipping belts, and require strict application of the principles of elasticity in the entire construction of the machine. Even with all this, the wear and tear in the ordinary hammers, as usually built, is far beyond what occurs with other machines, tending to counteract any inherent advantages that this special form may possess. The Bradley Manufacturing Company, of Syracuse, New York, has placed on exhibition one of its Rubber-Cushioned Helve-Hammers, represented by the engraving on page 382, which it claims possesses great advantages and improvements over any other hammer of its kind in use. With the exception of the helve, which is of wood, the entire hammer is constructed of iron and steel, so proportioned as to dispose of the material to the best possible advantage. The helve is hung upon two hardened adjustable steel centres and almost perfectly balanced, motion being given to it by a broad eccentric with an iron hub, a bronze shell and a cast-steel strap, all so perfectly fitted as to reduce friction to a minimum and to allow complete adjustment. Rubber cushions are provided and so arranged as to absorb the concussion of the blow of the hammer and materially decrease the strain and jar which ordinarily obtains. Set screws in the upper and lower sockets of the oscillator allow of adjustment to these cushions. The bearings throughout are of the best quality anti-friction metal, except those of the main shaft, which are of bronze; an adjustable eccentric is used, easily regulating the length of stroke required, and a universal joint connection prevents the possibility of binding or heating. By the method adopted of raising and lowering the husk, dies varying an inch in thickness may be used without shimming up either end, thus preserving the key-ways and hammer bolts. In securing the hammer-head to the helve, rubber cushions are used beneath the nuts and collars of the bolts, absorbing all concussion, preventing loosening or breakage and increasing the elasticity and flexibility of the blow. A foot treadle around the bed of the hammer allows the operator to stand in front on either side and by a gentle pressure bring the tightener in connection with the belt on the drive-pulley, varying the stroke as desired.

On removing the pressure, the brake acts at once on the balance-wheel and the hammer is brought to a stop instantly, with the helve always up. The action is the nearest approach to that of the human arm that it seems possible to obtain, being accurate and powerful, perfectly adjustable in length of stroke, rapidity of motion and weight or force of blow, and entirely under the control of the operator. Water, steam, or any other power may be applied.

It is claimed that not more than half the power is required to do a given amount of work that is necessary in the direct steam hammer. There is no liability to corrosion of steam chest, sticking of valves or freezing and bursting of pipes in winter from non-use. For intermittent use it is exceedingly well adapted, always responding to the touch of the treadle, be it once per day or once per week. Its *drawing* capacity and accuracy of stroke give it great advantages over the vertical or dead-stroke hammer. The play required in the guides or ways of the latter for expansion of the ram under heating, allowing it to run loose enough to shuckle, is fatal to nice die swedging. In this hammer, the centres being away from all heat, it strikes equally well whether the heat is expanded or not. It is claimed that as a drawing hammer it has no superior, and it is under such perfect control that a block of iron three inches square may be reduced to one-eighth inch square under the one hundred pound hammer without adjustment. A simple device allows adjustment from one power to another, as from a sixty pound to a forty pound hammer, in a few minutes. It is claimed that no hammer in use possesses the elasticity of stroke which this does. Objection is sometimes made to helve-hammers because they do not strike perfectly square on different thicknesses of work, but this is obviated in the construction of the dies, and in swedging it gives no trouble.

A certain class of machines technically known as Milling Machines have long been used in a somewhat crude state for a few special kinds of work, such as in the manufacture of fire-arms and sewing-machines, where the cheap and rapid duplication of

interchangeable parts was impossible with any other form of apparatus. The name arose from the kind of cutting tool employed, specifically known as a *mill* and consisting of a revolving wheel on the periphery of which the cutters are arranged like cogs to



"The Great Exhibition, 1876."

MILLING MACHINE.
By the Brainard Machine Co.

[Machinery Hall.

a mill-wheel, the action of the machine being directly the reverse of that in the lathe, the tool revolving on the work instead of the work on the tool.

When attempts were made to apply these machines to general work, defects were revealed so marked as to preclude their

employment except in few cases. This led to important improvements and developments on the old type, until of late years their capabilities have been largely extended and much more generally understood, and their use has grown rapidly in favor especially in the United States, and has become a necessity in almost every metal-working establishment.

The Brainard Milling Machine Company and its General Superintendent, Mr. Amos H. Brainard, with whom the subject has been a special study for many years, claim considerable credit for the improvements that have been effected and for the introduction of machines for general use, combining the requisite of capacity, convenience and power, together with beauty of design and perfection of workmanship. This Company manufactures Milling Machines exclusively, of various classes, and makes quite an extensive display in the Machinery Hall. What is known as its Standard Universal Milling Machine, holds the first position in importance among all the varieties produced, having all the movements and power of the plainer machines, with far greater range and capacity, and being applicable to an almost endless variety of work quite impossible with ordinary machines. Four different sizes of this class are made, all upon the same general plan, and we select for illustration the third, which is perhaps the most desirable for ordinary use, its weight, capacity and power being sufficient for general and quite heavy work without its being too large for quick handling and rapid running.

The engraving on page 386 is taken from a photograph of the machine as it stands at the exhibition, set for cutting a long, conical blank, spirally and automatically, an operation considered one of the most difficult and complicated ever required of a Milling Machine, and necessitating the use of a special mechanism. Its framing consists of a large square or four sided column, fixed on an ample base, upon the front of which is mounted a knee, which may be elevated or depressed by a screw worked by bevel-gearing and a crank; a dial and finger attached, allowing of adjustment to the one-thousandth part of an inch. The knee

supports a carriage which traverses upon it, and on the carriage is mounted a work-table, moving independently and having T shaped slots on its upper face, carefully milled lengthwise and crosswise, exactly in line with and at right angles to the feed, for the purpose of securing work. The table also has an oil channel entirely around it. Upon the top of the column is the driving cone, full geared, giving six speeds. The main arbor or spindle is of solid forged steel, and upon its front end a screw is cut so that a chuck or face plate may be attached. At the extreme top is a projecting arm which carries an outside centre support for the outer end of a mill spindle, allowing the use of cutters to a distance of fourteen inches from the front of the machine. This arm, notwithstanding its solid connection, can be easily removed when not required, or if desired to make other attachments. Automatic feed gearing is provided which is hung upon the back end of the spindle, connecting with a worm and worm gear which drives the feed-screw. The feed work is independent of any movement of knee, carriage or table, and provision is made, especially in the feed work, for wear of running parts and for taking up all slack motion. The feed-screw runs in bronze bushings, and bronze collars are interposed between running bearings to obviate wear and diminish friction. The spiral cutter, as shown, cuts a right-hand spiral, but a simple change of gearing causes it to cut a reverse or left-hand spiral, and both were cut upon the same piece of metal in the presence of visitors. Upon loosening three nuts the spiral cutting attachment may be removed, leaving the work-table flush and unobstructed. Various attachments are provided, such as a universal head, by which spur and bevel gears can be cut, and work milled at any angle or position; a rotary vise and many other devices, allowing an almost endless variety of work to be performed; fluting taps and seamers, finishing nuts and bolt heads, key-seating shafting, making all the cutters required for the machine, &c. Even without any of the special attachments the machine is admirably adapted for plain milling, and is in every respect far in advance of the common

style of machine. As it appears in the engraving it weighs about 1800 pounds, has a perpendicular range of 18 inches; the carriage will traverse 5 inches, and the work-table has a movement of 18 inches upon the carriage. The feed may be operated by hand from either end, or automatically, as desired. A door is provided in one side of the main standard which being hollow, furnishes an ample tool closet.

Messrs. Fauth & Co., of Washington, D. C., exhibit in the Main Building some excellent Astronomical and Geodetic Apparatus, among which we would mention particularly a fine Equatorial Telescope, which, although smaller than many others in use, is of a size best adapted for working under all circumstances, and belongs to that class of instruments by means of which with patient labor many of the best results in astronomical research have been achieved. The engraving on page 390 gives a very fair idea of the instrument. It has a clear aperture of nearly seven inches, a focal length of eight feet, and the lens was manufactured by Alvin Clarke & Sons, the celebrated opticians of Boston, Massachusetts. It is mounted on a pedestal which accompanies it, and very little expense is requisite to place it in working position,—a matter of considerable importance to those of limited means. Azimuth and latitude adjustment have been provided, allowing it to be regulated for almost any quarter of the globe, thus permitting great range of locality in its use. The great care that has been taken in designing the instrument, and the close attention that has been paid to the comforts and conveniences of the observer—giving him a perfect control over the whole machinery without compelling him to move from the eye-piece, thereby dispensing with the aid of an assistant—is one of the marked features of the apparatus. It can be turned to any quarter of the heavens with the greatest ease, and the operator without leaving his post, may readily move it in declination and right ascension to find the object he is seeking. Motion is given by clock-work, with which it may be connected or disconnected at will, and the clock may be adjusted to follow stars, planets or

the moon with the utmost precision. The hour circle reads to single seconds of time and the declination circle to five seconds of space,



EQUATORIAL TELESCOPE.

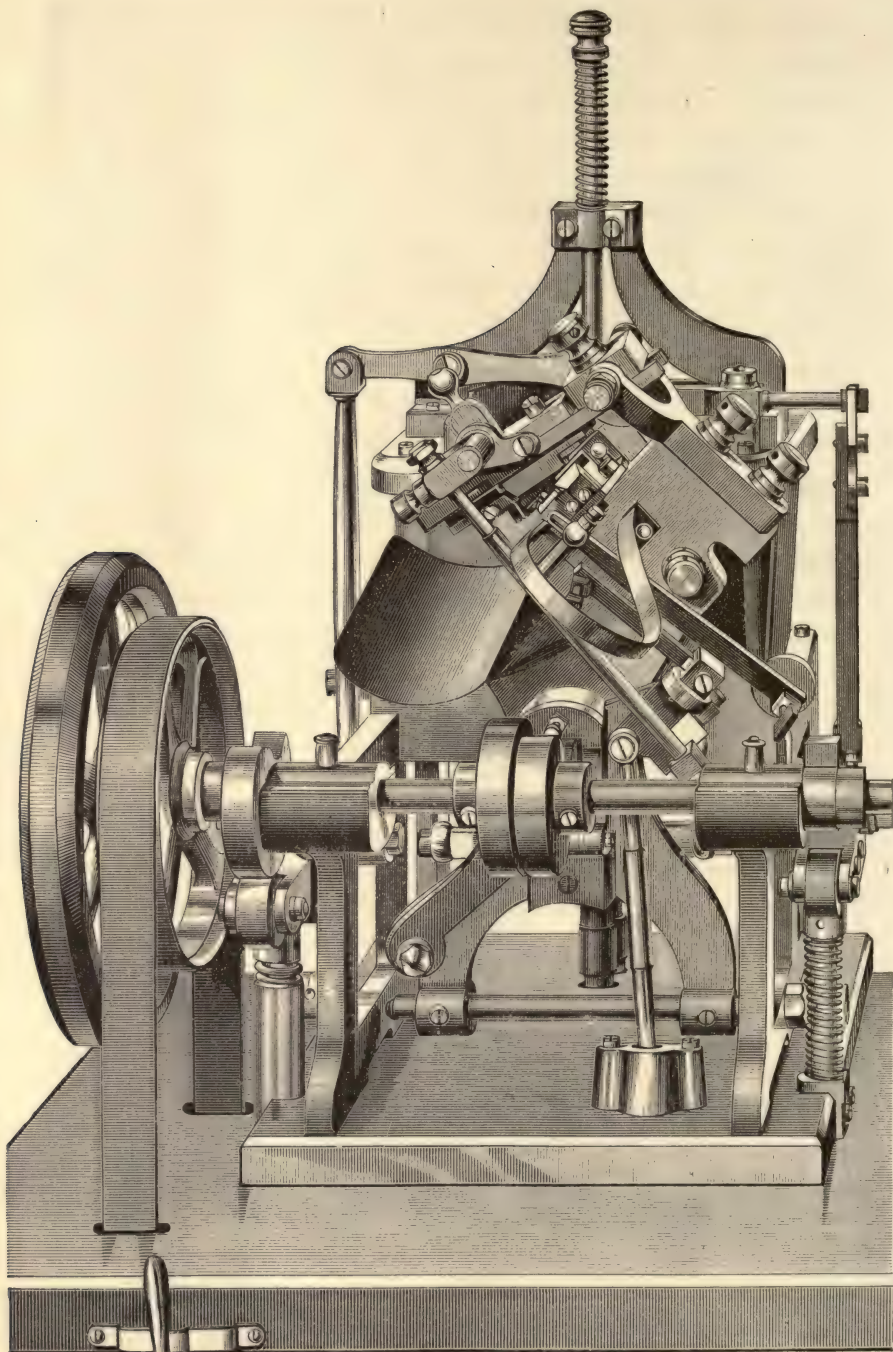
By Messrs. Fauth & Co.

two opposite verniers being used to each circle with lenses attached for reading. The position micrometer is a wonderfully accurate

piece of workmanship, combining in itself four distinct motions, and is especially adapted to measure minute differences of declination and positions of double stars. One division of the micrometer screw is equal to one ten-thousandth part of an inch. The attached circle permits angles of position to be read off to single minutes. The field of the instrument can be illuminated at pleasure with different colored light, as some stars show best this way, or it may be left dark for very faint objects and only the spider lines illuminated. Messrs. Fauth & Co. have made every endeavor to bring the construction of this instrument to perfection, as regards symmetry of form, kind of material employed, and style of workmanship, and inspection shows that their efforts have been crowned with success.

Among the large type-foundries in the United States, that of MacKellar, Smiths & Jordan, of Philadelphia, occupies the first position, and is well represented by an extensive display in Machinery Hall. This firm exhibits a number of modern type-casting machines, which may be operated by hand or power. These machines are constructed upon the same principle (whether operated by hand- or steam-power), and their average production is about one hundred per minute for the ordinary sizes of printing-type, being far beyond the amount of product of the earlier methods. The advantage in using power is that it enables one man to attend to two machines. Our illustration on page 392 shows a machine with steam attachment.

Type-metal is an amalgam of lead, antimony, copper and tin in such proportions as to produce a material hard but not brittle, ductile yet tough, flowing freely yet hardening quickly. Each letter is first cut in reverse shape on the end of a short strip of steel, the greatest care being taken to insure accuracy of proportion and harmony of appearance in the letters of the entire alphabet. The least variation is inadmissible, as it would destroy the harmonious effect of the types when composed or formed into columns or pages. The steel strips when finished are termed punches; and after criticism and approval, each punch is placed in a stamping-machine, and a deep impression made of it in one side of an oblong piece of copper near



"The Great Exhibition, 1876."

STEAM TYPE-CASTING MACHINE.
By Mac Kellar, Smiths & Jordan, Philadelphia.

[Machinery Hall.

its end. These pieces of copper are called matrices. They are dressed and fitted up with delicate skill, so that the types cast from them shall be of uniform height and accurate range. They are then ready for use in the casting-machine.

The machine casts but one type at each revolution. It consists of a furnace, on the top of which is a small reservoir of metal kept in a fluid state. In this reservoir is a pump, the plunger of which operates in a cylinder in the bottom, and projects at each stroke a small quantity of the molten metal out from a small hole in a spout or nipple in the front face. The mould in which the stem or body of the type is formed is of steel and is movable, being set in place in front of the reservoir and worked by the action of the same machinery which operates the pump. The copper matrix, containing any special letter stamped into it with the punch, rests with its face against the bottom opening of the mould, being held in position by a curved steel spring shown in the engraving. The method of operation is as follows: The initial movement of the machine brings the upper opening in the mould opposite to the matrix exactly against the hole in the nipple. A simultaneous action of the pump projects a stream of the liquid metal into the mould with considerable force, at the same time stopping the opening in the nipple by a small plug from behind to prevent the further escape of metal. The next movement draws the mould away from the nipple and opens it, throwing back the matrix, extricating the type and dropping it by a slide into a box below. This operation is repeated over and over again as rapidly as the crank or wheel of the machine is turned, and a type is cast each time. On the rapidity of the motion depends the quantity produced. Such is the modern type-casting machine—turning out one hundred types per minute, or sixty thousand per working-day of ten hours, every one of which is a mite contributed to the spreading of knowledge over the world for good or for evil.

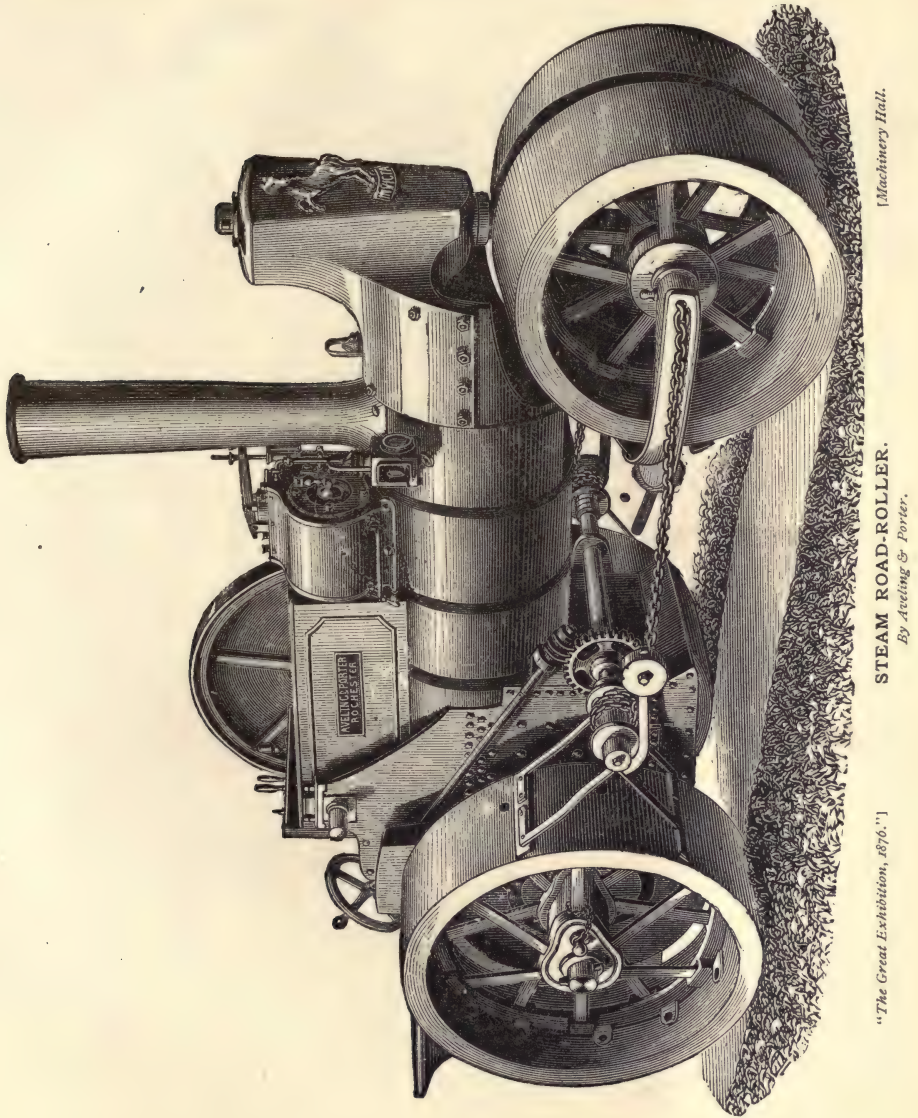
The type as thus formed is passed to boys, who break off the jets or waste ends; then to the dressing-room, where the rough edges are rubbed off on the faces of large circular stones; and finally, they are set up in lines, slipped into a long stick, screwed tight, and the

bottom of the type is neatly grooved by a planing-tool. The letters are afterward closely inspected with a magnifying-glass, and all imperfect ones rejected.

The exhibit of this firm is exceedingly well arranged, evincing great taste and a considerate regard for the interests of visitors, by showing them not only the modern type-machines themselves, but the various adjuncts of their establishment, as well as the tools used by this house in the last century. The exceptional excellence of their type is proved by the handsome appearance of our book, which is printed from them. Cases are also displayed containing type—the smallest not thicker than a pin—ancient and modern, plain and highly ornamented, and exquisite borders, crochet and music type, and numerous other essential matters for printers' use. These are all shown in their two magnificent Specimen Books, also on exhibition, which are printed in the highest style of typography; the matter of the lines displaying the types being original and exceedingly quaint, these remarkable volumes have no counterpart in the world. This foundry is the oldest in America, having been established in 1796 by Binny & Ronaldson, and claims to be the most complete in the world.

Messrs. Aveling & Porter, of Rochester, England, well known as occupying a high position in the specialty of Locomotives applicable to common roads, to agricultural purposes, to road rollers, etc., make a very creditable exhibit in the British Department of the Machinery Hall. One of their latest improvements, and an exceedingly important one in this class of machines, consists in their method of mounting the principal working parts of the locomotive, the crank-shaft, the counter-shaft and the driving axle, so as to prevent the unequal working of these parts from producing any injurious strain upon the boiler, a defect that has long been a fertile source of trouble in all engines of this kind. This is accomplished by prolonging the side plates of the fire-box upwards, as will readily be seen by the engraving on the next page, thus forming a complete arrangement for carrying the bearings of these working parts without connecting with the boiler directly. Many other improvements have been made

in these machines from time to time, and they may be regarded as possessing great simplicity, strength, durability and economy of working.



[Machinery Hall.

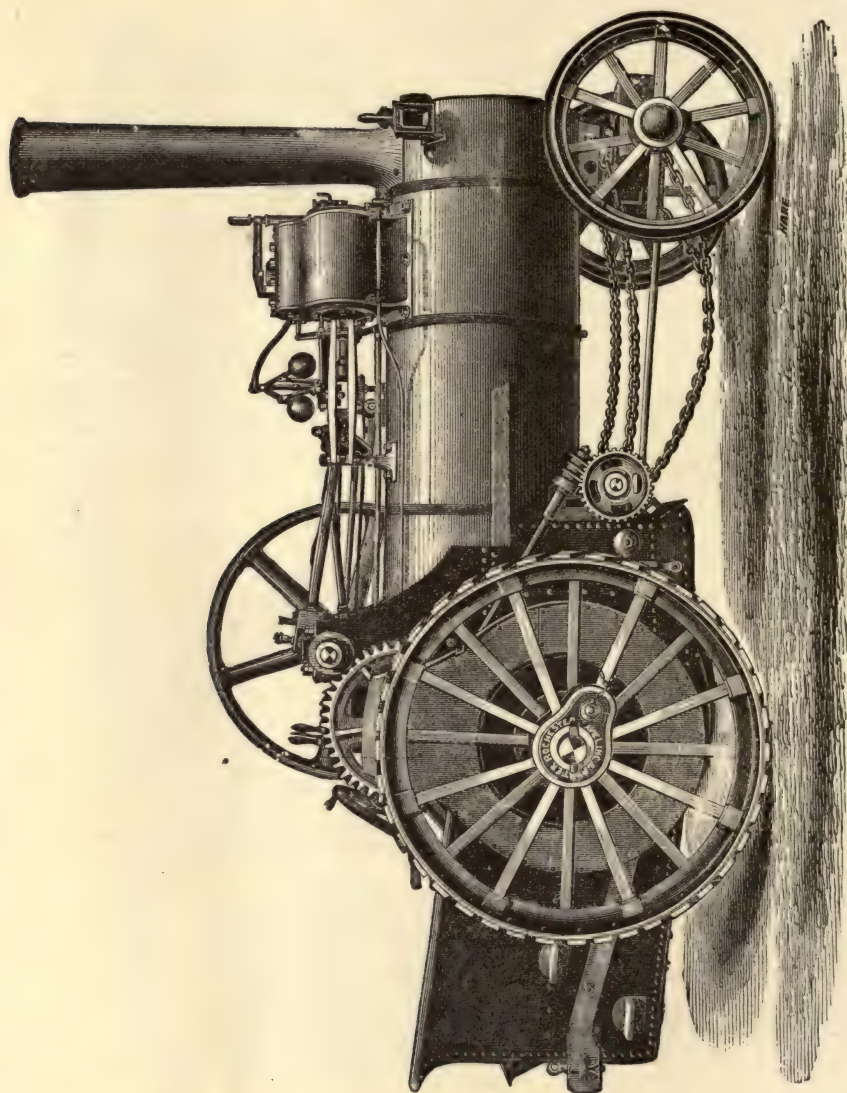
STEAM ROAD-ROLLER.

By Aveling & Porter.

"The Great Exhibition, 1876.")

In the "Road Locomotive Engine," a single cylinder is used and it is placed on the forward part of the boiler, preventing priming, dispensing with steam-pipes and resulting in considerable economy

of fuel. This cylinder is surrounded by a jacket, with which it is in direct communication, and the steam is taken into it from a dome



[Machinery Hall.

FARM LOCOMOTIVE ENGINE.

By J. A. Porter.

"The Great Exhibition, 1876."]

connected with the jacket. The driving-wheels are of wrought-iron, provided with compensation motion, so as to allow the turning of sharp curves without disconnecting either wheel and sustain about 85

per cent. of the weight of the engine. The steering is done from the foot-plate.

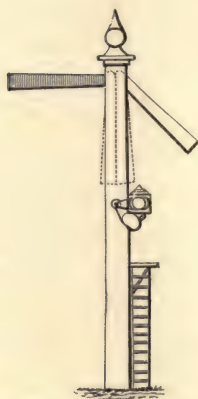
It is stated that the working expenses vary from $2\frac{1}{2}$ to 6 per cent. per ton per mile, depending upon whether the work is continuous or intermittent and the condition of the roads travelled over. Whenever circumstances render the use of the ordinary rigid tires objectionable, the wheels are fitted with the spring tires of W. Bridges Adams, consisting of inner and outer tire-frames, having solid blocks of India-rubber between them, and connected together by a "drag-link," to prevent friction on the rubber blocks.

Cranes are attached to the front of these engines when desired, very much increasing their usefulness in dock-yards, quarries, etc., and those visiting the Exhibition Grounds during the moving and placing of the exhibits have no doubt noticed the effective work performed by one of these machines in use by the British Commission.

The general characteristics of the "Agricultural Locomotive" are very similar to those of the "Road Locomotive," and this apparatus is expressly adapted to the working of machines for steam cultivation, threshing, sawing, pumping, or other agricultural duty.

During the early years of railway management, when traffic was light and the number of trains few, a very simple system of signals was quite sufficient for the proper regulation of these trains. Hand signals, with flags by day and lamps by night—different colors being employed, red generally for danger, blue or green for caution, and white for safety—answered all purposes. As business developed, however, and as the turnouts and crossings at stations increased in complication, it became evident that something better than these primitive methods must be adopted. Stationary signals were then introduced, elevated at some height above the level of the rails, so as to be seen from a considerable distance, and they were placed at safety or danger as required to correspond with the clearing or blocking of the line. That known as the Semaphore signal, consisting of a vertical post with a movable arm attached near the top by a pivot, and capable of hanging vertically or of being moved out at right angles to the post, was the form

of signal most universally adopted, proving so superior to all other kinds as to rapidly replace them. When the arm was thrown out at right angles to the post, it signified danger; when hanging vertically, it denoted safety; and when inclined at an angle of forty-five degrees, it expressed caution. The movable arm was counter-weighted, so that in case of derangement of the apparatus or breakage of connections, it always flew out to "Danger," stopping all



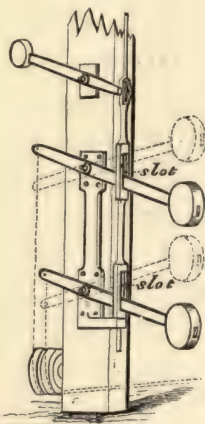
RAILWAY SIGNALS.

Fig. 1.

traffic, and at the worst only causing delay. As the system of tracks became still more complicated, arms were introduced on both sides of the post, and occasionally two or more tiers of arms, one above the other, the arms on one side always referring to trains in one direction, and those on the other side to trains in the other

direction. The arms were painted red on the side next to the approaching trains they were intended to govern, and white on the other side, so as to appear less prominent and avoid confusion. Lamps were attached to the post for night use, the movement of red or green glass over the white glass indicating the desired signals.

Where several arms were in use it became necessary to number them or mark them with symbols so as to distinguish them apart and signify to which set of tracks each signal belonged.



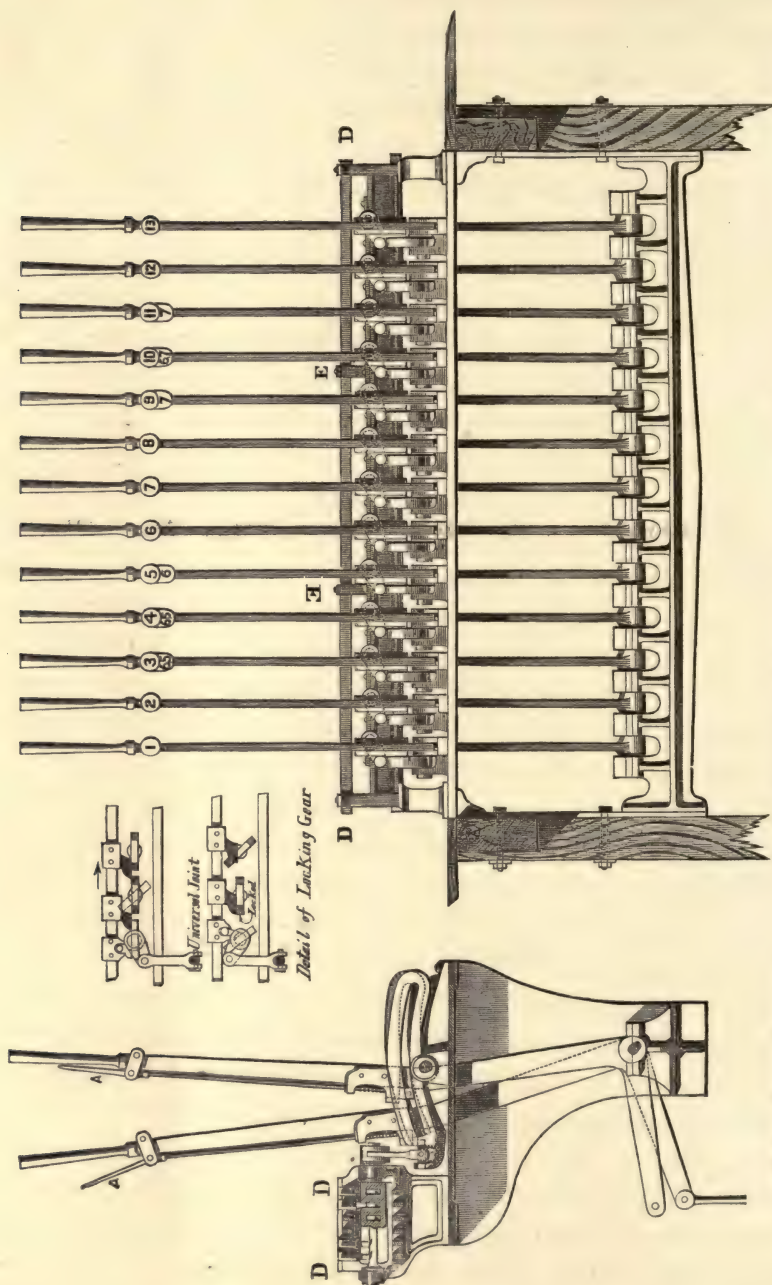
RAILWAY SIGNALS.

Fig. 2.

The Semaphore signal was found eminently satisfactory, continuing in use to the present day, but the method of operating it was quite inefficient. By errors of the signal-men, signals were sometimes given for wrong tracks, or switches were opened before the danger signal was turned on, or sometimes the danger signal changed to safety before the switches were set right, resulting often in cases of serious accident. The obvious remedy for this was to make the movement of the signal automatic with the movement of the switch, or, better still, to make the movement of the danger signals obligatory before the track could be blocked, or the clearing of the track obligatory before the safety signals could be set. The solution of this problem, step by step, has resulted in a system of apparatus so complete as to leave little if anything to be desired.

Messrs. Saxby & Farmer, of London and Brussels, have been early and strongly identified with this system, taking out patents in England as long ago as 1856, and in this country in 1868. They are represented by an exceedingly handsome and complete working model at the Exhibition, and we cannot explain better the latest and most novel improvements in this direction than by a description of their apparatus.

On the preceding page we present an engraving, Fig. 1, showing the Semaphore signal, and also one of the Semaphore with slotted rod, Fig. 2. It is exceedingly desirable in certain cases that two signal-men should control one signal, so that the consent of both should be necessary to its use. This is arranged in a simple manner by means of two slots on the signal-rod, in which pivoted levers move up and down, each being operated by a separate signal-man. It is evident that both levers must be moved the same way before any change can be effected in the signal, and that such change must be in concordance with the intentions of both operators. This principle, which is capable of almost unlimited extension, and allows any number of slots, in which a pointed lever or pin may work, was the germ of the system introduced by Mr. Saxby, in 1856, in his invention of combined interlocking



"The Great Exhibition, 1876."

SYSTEM OF RAILWAY SIGNALS.
By Stacy & Farmer.

[Machinery Hall.]

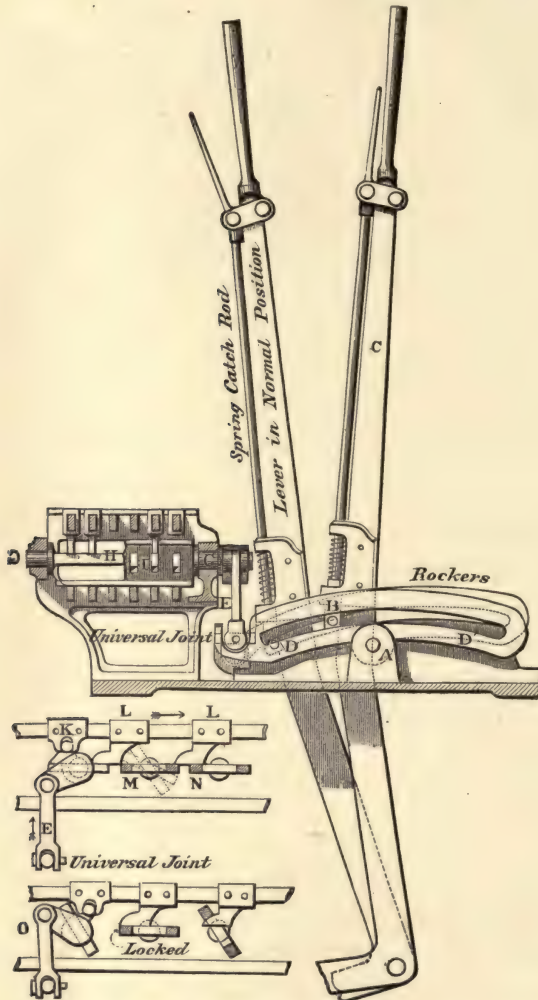
signals, by which it was rendered mechanically impossible to make the position of the switches contradictory to the position of the signals, or to allow irreconcilable signals to be given, no matter how complicated the system of tracks or switches.

In arranging a Saxby & Farmer apparatus at any particular station or junction, a convenient site is selected, on which is erected a signal-tower, or building with a second story, having large windows, and well overlooking the arrangement of tracks. In this is placed a set of levers, arranged in a cast-iron frame side by side, and by which the whole system of signals and switches is operated. Some work the switches and others the signals, the former by rod connections, and the latter usually by wire rope.

Fig. 3 shows this arrangement of levers for some particular station, the name generally given to it being the "Locking Apparatus," for the reason that the levers are so interlocked that the switches must be properly set and locked in the right direction before it is possible to move the signal-lever corresponding, and the signals themselves are so interlocked, so as to protect the path of a signal train, throughout its whole length, from all crossing lines. It will be noticed that each lever is numbered, and that some have one or more secondary numbers under the principal number. These numbers are to guide the operator, and the secondary numbers specify the levers which control the principal lever, and which must be moved before any movement of the principal can be made. For instance, suppose lever No. 11, having under it secondary No. 7, operates a certain switch. Before it is possible to use it, lever No. 7 must be moved, acting on the danger signal, and covering the opening of this switch by No. 11. It is evident that with this system it is impossible to make a mistake causing any further inconvenience to an approaching train than possible delay.

In describing the method by which this locking is accomplished, we will refer to Fig. 4, and we would state that an important advantage belongs to this apparatus in the fact that the interlocking gear is actuated solely by the movement of the spring catch-rod

in front of the lever and attached to it. This spring catch-rod carries a stud, upon which is a small block, B, which travels in the curved slot of the rocker, D, a segmental plate, movable on



SYSTEM OF RAILWAY SIGNALS. FIG. 4.

By Saxby & Farmer.

the centre, A. When the lever is thrown forward or backward to its full position, the spring catch fits into a notch in the fixed quadrant on which it moves. When it is in its forward or normal

position, to the front of the frame, with the spring catch-rod down, the left-hand end of the rocker is depressed, and the right-hand end raised, as shown by the dotted lines. When the spring catch-rod is raised, the rocker moves into the position shown by full lines, and keeps this position until the spring catch falls into the notch at the rear of the frame, when it assumes a third position, elevated on the left and depressed on the right. A jaw at the left-hand end of the rocker carries a universal jointed vertical link, E, giving motion to a small crank at the end of a spindle, the bearings of which are shown at G, G, there being a spindle for each lever. These spindles lie directly under a series of horizontal rectangular bars, shown at D, D, in Fig. 3, called locking-bars, and to these are attached pieces of iron, E, E, Fig. 3, or L, L, Fig. 4, called locks.

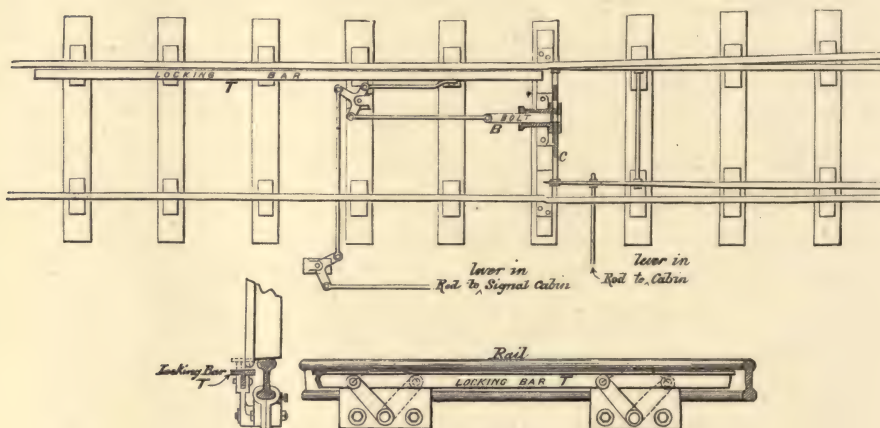
The spindles are flat in their central portion, as shown at M and N, Fig. 4, and when they stand in their normal position they are horizontal, and the locking-bars and locks are free to move forward and back over them. When turned up, however, out of the horizontal, as shown at I, and in dotted lines at M, they catch on the locks and stop their movement and that of the bars to which they are attached. Some of the spindles are required to work locking-bars, and are provided with a short vertical crank, the stud of which works between two horns on the locking-bar, as shown at K, giving a horizontal motion to the bar at any movement of the spindle.

It will be seen that the locks and crank attachments may be fixed at any locations desired on the locking-bars, by means of set screws or a similar arrangement, some being made to allow free movement of one spindle, as at M, while at the same time another spindle, as at N, is locked.

Whenever the spring catch of any lever is raised, its rocker is lifted and the corresponding spindle turned. If the spindle is locked it will be impossible to move the spring catch. A very small movement of the spring catch, if the spindle is free, will cant it up sufficiently to lock the locking-bar upon which it works and prevent any movement of it by other levers.

The spindle can occupy three positions, as shown at M: first the horizontal, when the lever is in its normal position; second, slightly inclined, as shown by dotted lines, when the lever is being moved; and third, a more inclined position, also shown dotted, when the lever has been pulled to its full open position and the spring catch released.

The third position is a very important one, some of the locks not being released until this position is attained. Thus the spindle N is not released until that at O is in the third position, and the lock over it has moved sufficiently to be able to enter a hole in



SYSTEM OF RAILWAY SIGNALS. FIG. 5.

By Saxby & Farmer.

it. The spindle then by its new position prevents a return movement of the lock or any change of the spindle O until brought back to the horizontal again, corresponding to the lowering of the spring catch into the forward notch of the quadrant. By this interlocking apparatus it is possible to absolutely prevent any signal-man from even commencing to make a movement of either switches or signals until all switches or signals which have any relation to the movement intended to be made have been effectually locked in their proper positions, a matter of the utmost importance.

By the system here explained it may readily be understood that any combination or arrangement of interlocking different levers

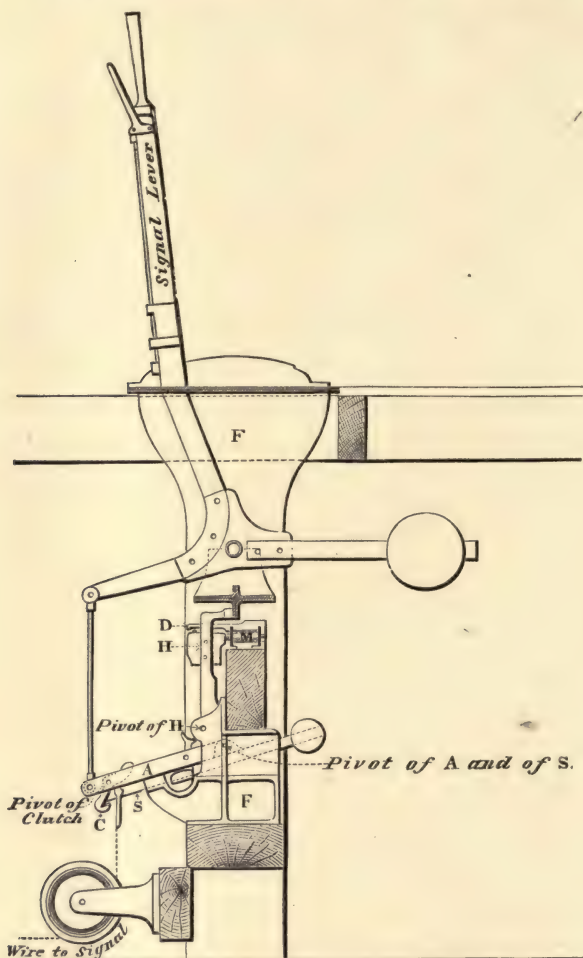
may be made as desired, that changes can be made to accommodate alterations to tracks or switches by merely moving the positions of the locks, and also that extensions of the apparatus can be economically effected to suit extensions of business without throwing away the portion already in use.

Messrs. Saxby & Farmer also provide a "Patent Facing Point Lock," which insures that the switches shall be properly closed and locked before a train can be signaled over them, and also prevents the possibility of the switchman moving the switches while the train is passing. This apparatus, shown by Fig. 5, is worked by a lever in the "locking apparatus," and the interlocking of the levers forces the switchman to use this lock before giving the signal. A cross-rod connects the two switch-rails near their movable ends, and in this are two holes, so that the switch may be locked for either position. A taper bolt shoots into one or the other of these holes, bringing the apparatus up home, and keeping it snug and tight. If the switches are not properly closed, the bolt will not enter the hole, and the facing switch lock lever in the apparatus will not work, and will consequently prevent the safety signal being given.

In order to prevent any danger of a signal-man carelessly moving the switch-rails while a train is passing over them, a switch locking-bar is provided, consisting of a bar at least as long as the greatest distance between any two pairs of wheels of a car, placed on the inner side of one of the fixed rails immediately adjoining the switch-rail, and connected with the system by which the lock-bolt just described is worked. It is hinged on short links lying in a vertical plane, so that it cannot be moved lengthwise without at the same time being raised. Then the lock-bolt is at either end of its stroke, the bar is at its lowest level, and just allows the flanges of the wheels to pass over its length. When an attempt is made to move the lock-bolt for either of its extreme positions, the switchman is unable to do so without raising the bar, which cannot be done so long as the cars are passing over it.

We have before mentioned the great advantages resulting from the use of slotted signal-rods, rendering it impossible for disagree-

ment to take place between signal-men who by mechanical means jointly control a signal, although they may be a considerable distance apart. Messrs. Saxby & Farmer exhibit in this connection Farmer & Tyer's patent "Electric Slot Apparatus," by means of



SYSTEM OF RAILWAY SIGNALS. FIG. 6.

By Saxby & Farmer.

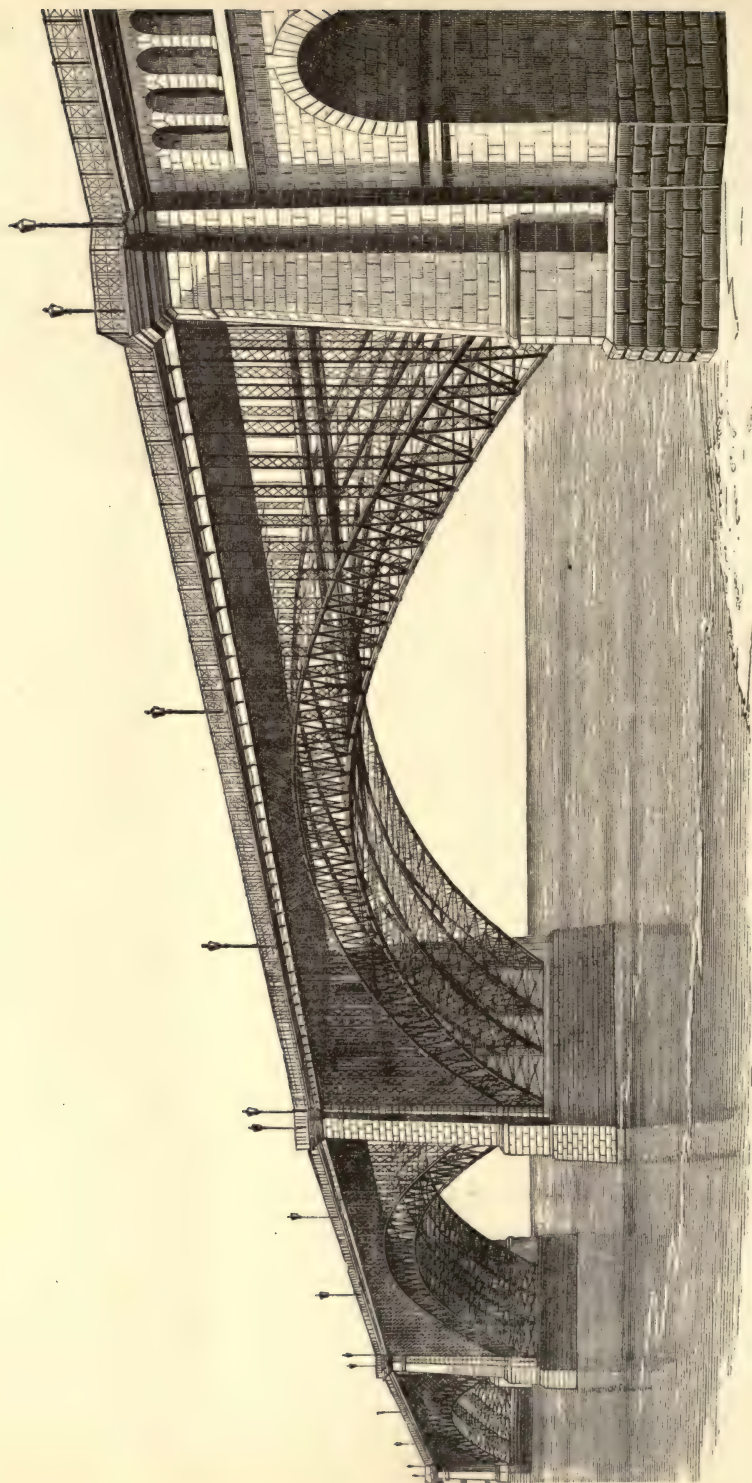
which the same result can be accomplished for an unlimited distance between the signal-men. This may be applied to their ordinary locking apparatus without difficulty, and carries out, by means of an electric current, all the advantages of the mechanical slot.

Fig. 6 represents one of the signal levers of the locking apparatus to which this arrangement has been attached. A is a lever consisting of a pair of wrought-iron plates placed side by side, with a space of about three inches between them. This lever is worked by a connecting-rod from the signal lever, and the clutch, C, pivoted to it, connects it with the lever, S, acting on the same pivot as A, and working the signal. H is a hammer, so pivoted that a small upward movement of A will raise H to the nearly vertical position in which it is shown. M is an electro-magnet, and D a detent. When the lever, S, is free, and not held by the clutch, C, the signal always flies to "Danger."

The electro-magnet, M, when under the action of an electric current, holds the hammer, H, in place, being further assisted by the detent, D, also under its influence. If the current be broken, the hammer, H, falls on to the clutch, C, releasing the bar, S, and placing the signal at danger. When the current is broken, therefore, it is impossible for the signal-man at the lever to move the signal from danger, no matter how often he moves the lever back and forth, and by putting the control of the current around the electro-magnet, M, under the charge of the other signal-man, he can control the signal as he desires.

This invention gives each signal-man on a block system, in addition to the usual block telegraph instruments, the actual mechanical control over the signals at the next station, controlling the coming train even before it enters his section of road. Messrs. Saxby & Farmer also show an admirable arrangement of gates for level crossings, so arranged that danger-signals are displayed whenever the gates are shut across the railway, and cannot be lowered until the gates are opened again and shut across the public roadway. The gates are connected to a lever similar to a switch-lever, and by a rack and pinion movement all gates are shut and opened simultaneously, the lever being made to interlock with the signals.

The Keystone Bridge Company, of Pittsburgh and Philadelphia, exhibit in the Main Building a beautiful model, on a scale of



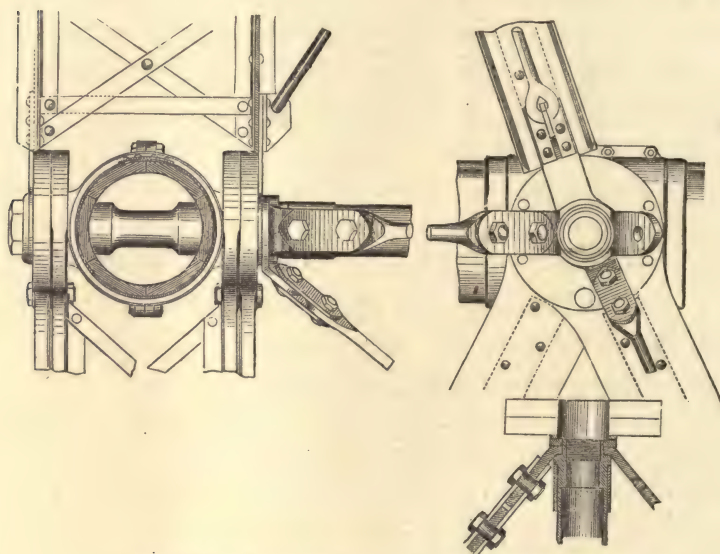
ILLINOIS AND ST. LOUIS BRIDGE.
By the Keystone Bridge Co.

one twenty-fourth the full size, of the swing-bridge which it has recently erected over the Raritan Bay, New Jersey, for the New York and Long Branch Railroad Company. The bridge was designed by J. H. Linville, C. E., the President and Engineer of the Keystone Company, and is four hundred and seventy-two feet in total length, being the longest pivot-span ever built in the United States, and believed to be the longest in the world. It is what is denominated a through bridge for a single track, and consists of two trusses, forty feet high at the centre, and thirty feet at the extremities, calculated for a maximum live load of two thousand five hundred pounds per lineal foot, and a constant dead load of four thousand five hundred pounds per lineal foot, the parts being proportioned so as to resist the stresses due to the dead weight of the bridge when open, as well as the dead and live load when closed, and operating as two spans of ordinary bridge. The upper and lower chords are consequently calculated for both tension and compression. The whole construction of the bridge is in wrought iron, the post being hollow and readily accessible for painting on the interior surface. The structure is supported on the rotating pier by a central drum, the load being transferred either to a central anti-friction cone-bearing pivot or to a series of thirty bearing-wheels under the drum, two feet in diameter, twelve inches face, and traversing between steel-faced tracks. By means of centre suspension bolts in the drum, the weight may be adjusted either partly or entirely on the central pivot or on the bearing-wheels, as found to be most desirable.

The lower chords of the bridge are parted at the centre, so that by means of wedges the ends of the trusses may be adjusted to any required elevation. Before swinging the bridge open, the entire structure is lifted about four inches by four hydraulic rams placed in transverse girders of the central drum under the four central posts of the trusses, and operated by a double engine having two cylinders of eight inches diameter and ten inches stroke, the same engine being also employed to turn the bridge. The turning-gear is brought into action by a friction-clutch, there being two pinions

which are made to act equally on opposite parts of the rack by an equalizing attachment in a large mitre-wheel placed between the shafts that drive them.

Automatic locks fasten the bridge at both ends when it is rotated into the line of track, and it is then lowered on to solid bearings on the drum and at the extremities by simply turning a valve, the projecting rails of the track fitting into the same shoes that receive the rails of the permanent spans. About one-half of the dead weight of the structure is made to bear upon the solid

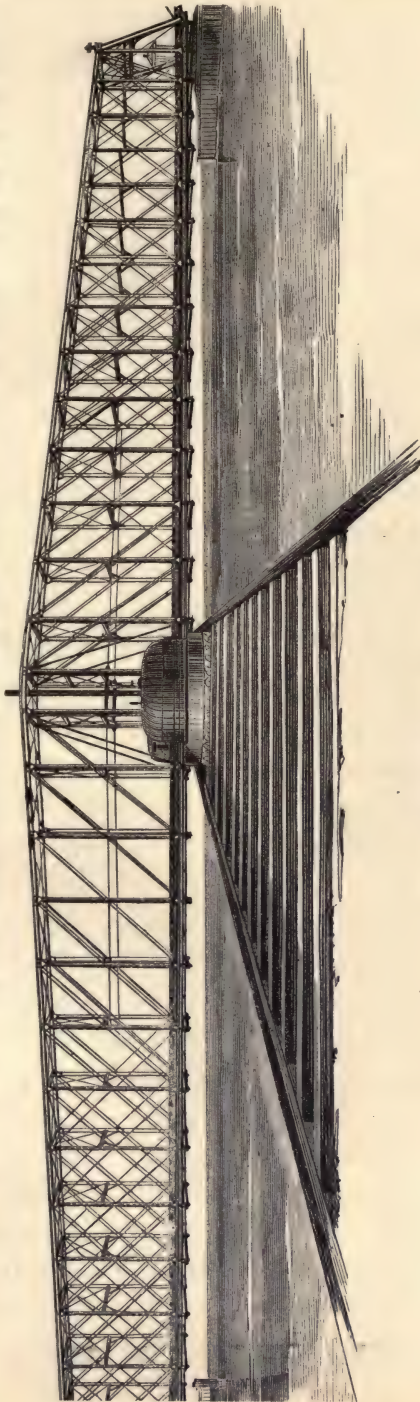


DETAILS OF THE ILLINOIS AND ST. LOUIS BRIDGE.

By the Keystone Bridge Co.

adjustable supports of the rest piers, the bridge by this arrangement being rendered firm and steady under the load of passing trains, the trusses acting as two independent spans. Therefore when one arm is loaded no effect takes place in the other arm, and no provision is required for holding this arm down, or otherwise providing as necessary in the case of continuous girder swing-bridges. The bridge has been designed as a cantilever under dead load when swung, and as two independent spans under dead and live load when closed, this being considered by the engineer

as the most satisfactory plan; and by means of a slotted link connection at the centres of upper chords, the continuity may easily be destroyed when the bridge acts as two spans. The operation of lifting the bridge by the rams as previously mentioned, before swinging, renders the practical execution of this principle entirely feasible. The weight of the entire structure above the drum is six hundred tons, and the engine, turning-gear and hydraulic machinery op-



SWING-BRIDGE OVER RARITAN BAY.
By the Keystone Bridge Co.

erate the whole with ease.

The Keystone Bridge Company in this connection also make an exhibit illustrating the method adopted for forming and uniting the steel tubes used in the arches of the great bridge over the Mississippi River at St. Louis, and the accompanying engraving will serve to explain more clearly our description of the same. This bridge, the largest arched bridge in the world, with its spans of five hundred and twenty and five hundred and fifteen feet,

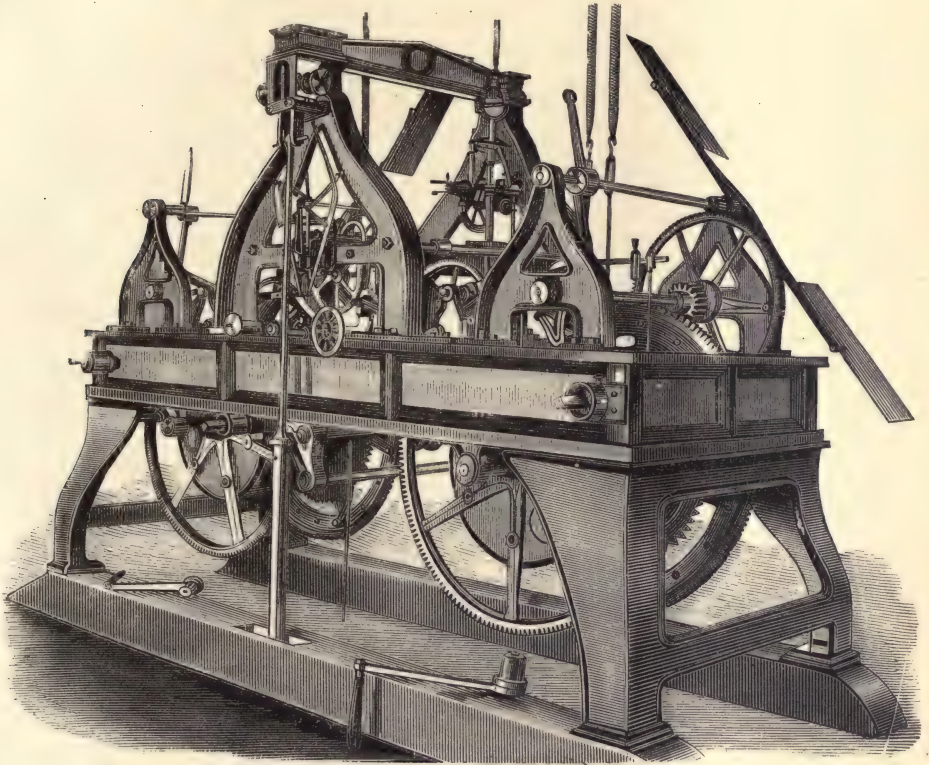
was designed by Captain James B. Eads as Chief Engineer, and the superstructure was manufactured from his designs and erected by the Keystone Bridge Company. The tubes of the arches are composed of six rolled cast-steel staves forced into a cylindrical envelope of steel, the lengths of sections between the joints being about twelve feet, and the depth of the arched rib between the centres of two concentric tubes about the same. The two lines of tubes are braced together, and the ends of contiguous sections are united by couplings made in two parts with projections turned on the inner surface to fit into corresponding grooves on the ends of the tubes. The connecting-pin for lateral struts, diagonals and lateral bracing between the several arches is tapered and driven tightly into the joint, the whole connection being made water-tight.

We present an engraving of the bridge, on page 408, which will give the reader an excellent idea of its general design and magnitude. The arches were built outward simultaneously from the abutments and from each side of the piers, being supported by means of direct guys, composed of two lines of main cables of forty-two square inches section, passing over towers to anchorages on the shore, and by guys balanced over towers on the piers. The towers stood on hydraulic rams, which were caused by automatic gauges to rise and fall, to compensate for changes of temperature in the arches and cables.

The Keystone Bridge Company also make a handsome display of photographs of large span bridges constructed by them, the Parkersburg and Bellaire bridges of three hundred and forty-eight feet span, the Newport and Cincinnati bridge of four hundred and twenty feet, etc., etc., and a fine perspective of the High River bridge of the Cincinnati Southern Railway over the Ohio, with spans up to five hundred and twenty feet.

The United States has been noted for many years for the manufacture of cheap, serviceable varieties of clocks, the production of late amounting to over a million annually, and immense exportations being made to all parts of Europe, Asia, Africa, China, Japan, South America, etc., until the "Yankee Clock" has become

a household word in every quarter of the known world. It is only within the past twenty years, however, that the construction of Tower Clocks has been undertaken in this country, the supply having hitherto been procured from abroad. Lately a number of firms have been engaged in this business, with remarkable success, obtaining in a short space of time quite a celebrity, and notably



THE GREAT CLOCK IN MACHINERY HALL.

By the Seth Thomas Clock Co.

among them may be mentioned the "Seth Thomas Clock Company," one of whose clocks has been placed on exhibition, in working condition, over the east entrance of the Machinery Hall. Its mechanism is shown by the engraving above, and the details of its construction have been carried out in great perfection, bronze metal being used for the wheels, except in the case of the

winding-gear, which is of iron. It strikes the hours and quarters upon two bells, the power being sufficient for these to be extra heavy.

An idea may be gained of the size of the clock when it is stated that the main frame is ten feet long by three and a half feet wide and seven feet high from the floor, and that the total weight is seven thousand pounds. In the striking apparatus the main wheels are forty-one inches in diameter and the drums for cords twenty-three inches. The main time-wheel has a diameter of twenty-four inches, and the drum for cord twelve inches. The pendulum has a zinc compensation-rod fourteen and a half feet long and beats once in two seconds, the weight, including pendulum-bob, being five hundred pounds. Dennison's Gravity Escapement is used. Arrangements have been made to run twenty-six electrical clocks from the main clock, to be located in different parts of of the building, and to make connection every twenty seconds. The clocks manufactured by this Company are remarkable for their accuracy and the perfection of their mechanism, and have obtained a reputation as first-class time-keepers in every respect.

The mineral Asbestos, although familiar to the ancients and employed by them in the manufacture of a fire-proof cremation-cloth and for some other purposes, has, in modern times—until within the last few years—been classed among those substances more curious than useful. The silky, fibrous nature which it possesses, and its well-known fire-proof and non-conducting qualities and resistance to the action of acids have, however, at last attracted attention, and we are indebted to Mr. H. W. Johns, of New York, for its adaptation to some very important purposes in the useful arts. We present on the next page an engraving of an exceedingly characteristic specimen of this mineral which has been placed among the exhibits.

Asbestos exists in vast quantities in the United States and numerous other parts of the world. It is obtained from the mines either in bundles of soft, silky fibre or in hard blocks which are capable of separation into fibres. These fibres vary in length from

two to forty inches, are of a greasy nature and exceedingly flexible, possessing great strength in the direction of their length, and are therefore capable of being woven into cloth as used by the ancients. These properties possessed by asbestos render it an excellent substance to incorporate into cements—as hair is put into plaster—to bind the parts together and at the same time to give body to the material, and it was this use that Mr. Johns first made of it.

The facilities for obtaining the mineral were very poor—there never having been any demand for it in the market—but as the



ASBESTOS IN ITS NATURAL STATE.

By H. W. Johns.

want was created and it really existed in nature in great quantities, these facilities soon increased and with abundance of material Mr. Johns was enabled to utilize it for other and more important purposes. It was found to make an excellent roofing material. Sometimes it is applied in the form of an asbestos concrete and spread over the roof by a trowel, but more generally a peculiar roofing felt—into the composition of which asbestos largely enters—it is first nailed down on the sheathing boards, and this is then covered by means of a brush with a preparation of flocculent asbestos, silica paint, etc., making an entirely water-, fire- and

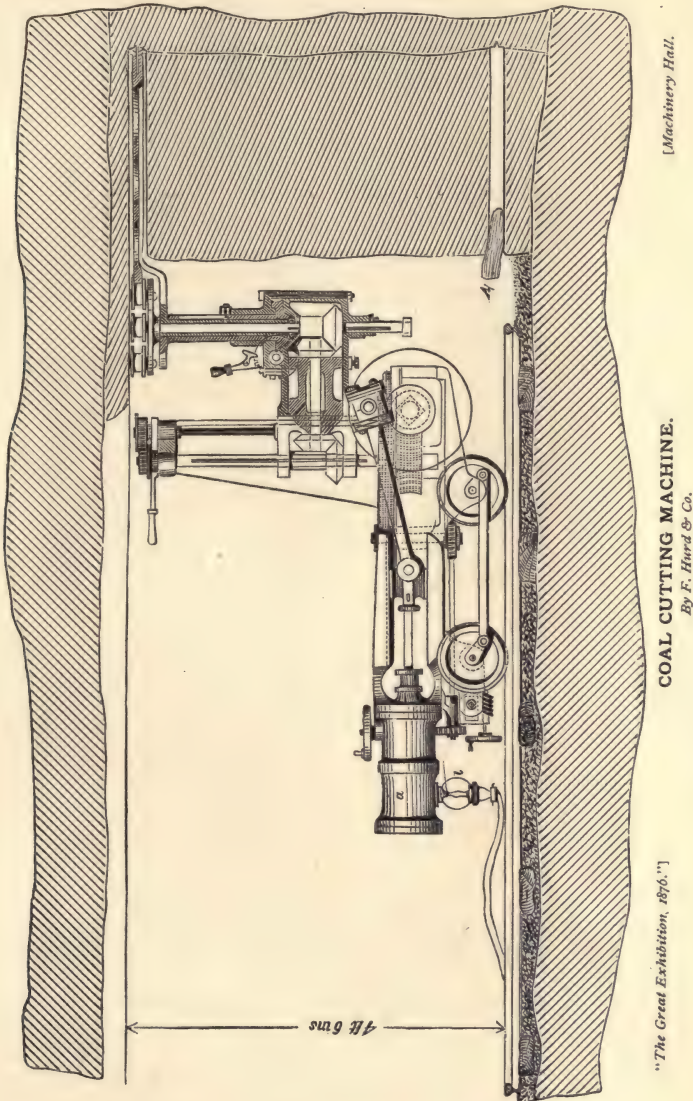
weather-proof surface, a good non-conductor of heat, well adapted to all climates and costing a very reasonable price.

Its non-conducting qualities render asbestos peculiarly applicable as a covering for steam-boilers, pipes, etc., and it has largely been used for this purpose. One of its most recent applications has been for steam-packing. The elevated temperature, moisture and friction to which steam-packing is subjected requires a material possessing just the qualifications existing in the asbestos, and experience has shown its great adaptability to this use. As a body for paints, being mixed with linseed-oil and colors, it has succeeded remarkably well; an asbestos paper is made incombustible and very useful for filtering acids, and every day new applications are discovered for this material, so few years ago supposed to be worthless.

Messrs. Frederick Hurd & Co., of Wakefield, England, exhibit a Coal-Cutting Machine, which appears to present some novelties in design and to be a very desirable form of apparatus for our mines, cutting gangway as well as room-work. We refer more particularly to the pattern for four feet to four and a half feet seams, smaller seams not being, as a rule, worked with profit in this country. The illustrations accompanying—presented on pages 417 and 418—will give the reader an idea of the construction and mode of action of this machine. The value and importance of reliable coal-cutting machinery is increasing every day, tending to dispense with the most exhausting and dangerous part of a miner's work, to lessen by a very large amount the waste or slack always obtained in getting out coal, and to obviate the expense, trouble and unreliability of hand-labor.

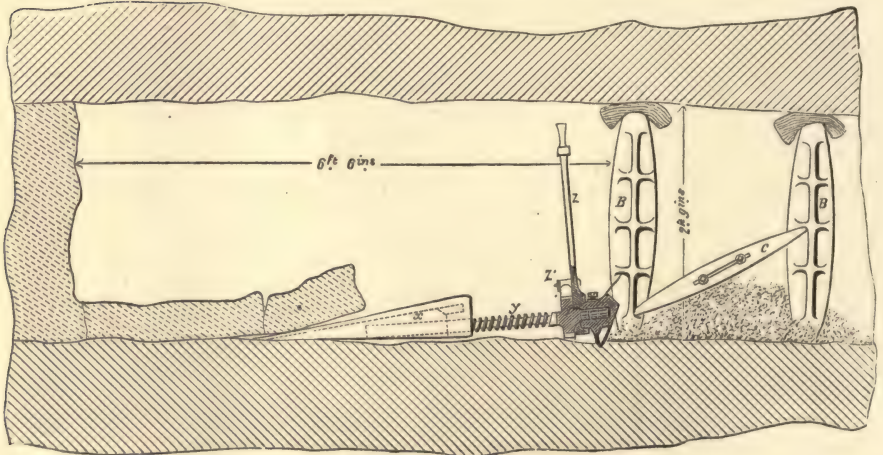
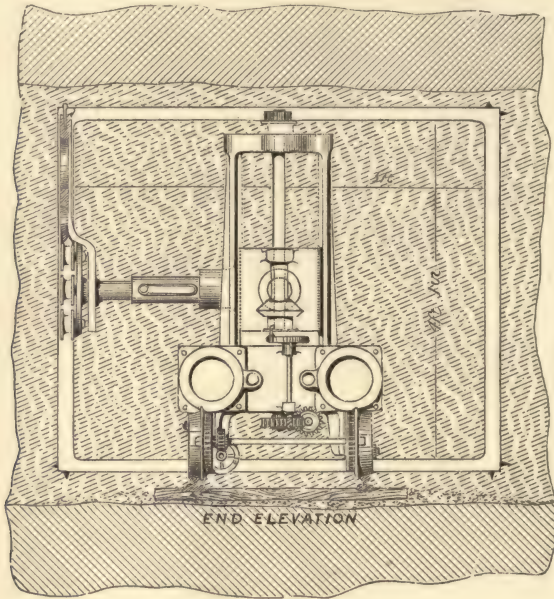
The machine is provided with two cylinders of six inches diameter and twelve inches stroke, and works by the action of compressed air. This has been found the most satisfactory motive power that can be used for mining machinery, being easy of application, and, at the same time, improving the ventilation and reducing liability to fire. Motion is given to the cutters by bevel gearing, and the shaft driving the cutters, by a simple arrange-

ment, is made capable of being revolved in a vertical plane about the horizontal shaft, thus providing for cutting out all four



faces of the drift, quite an advantage over the usual machines which make only the under-cut. In the cutting-wheel the periphery in which the cutters are fixed is placed eccentric to the fulcrum

on which they revolve, and the pressure is resisted by anti-friction bowls, which also act as drivers, thus dispensing with guides



COAL CUTTING MACHINE, FIGS. 2 AND 3.

By F. Hurd & Co.

and slides. The cutters are put in or taken out of cut by a swivel-nut and screw acting on the lever or radial arm in which they revolve, or by a pinion and quadrant. They are made of

plain, square, Titanic steel, manufactured by S. Osborne & Co., of Sheffield, and are set sideways, above and below, allowing for the clearance of the disk, being readily adjusted radially to vary the depth of the cut according to the quality of the coal or mineral.

The leading wheels of the machine are kept in position on the rails when at work, by a bowl mounted in a differential lever, with self-acting adjustment to adapt itself to irregularities on the coal face without the possibility of getting off the rails while at work.

After removing the coal included within the cuts, a sort of wedge shovel, as shown by Fig. 3, is used to raise up and remove the lower portion of the seam. The form of post shown in this figure is not nearly so good as the French post, where the bottom is placed in a ring containing sand, so that if the roof presses down and holds it, it can be relieved by letting some of the sand run out, being on the same principle as the method of supporting the centres for arch bridges by sand-tubes.

None but those who habitually practice an art, can be aware of the nature and the extent of the influence of the raw materials its professors are obliged to employ, upon the external expression of the art itself; and, indeed, it requires rather a subtle analysis of the workings of human genius, before due importance can be assigned to the accidental or local peculiarities to which that genius may be subjected. Yet even a very cursory glance at the history of the building arts must suffice to show that their various phases have depended, in a degree only inferior to those connected with social and religious institutions, upon the materials the nations which have in turn carried forward the torch of civilization have habitually employed. The porphyries and granites of Egypt; the bricks and alabasters of Assyria; the rocks of India; the marbles of Greece; the bricks and pozzuolanos of Rome; the small rubble masonry of the middle ages; the large ashler stones of modern France and Italy; the bricks of England, Holland, Belgium, etc.; and, now, the application of iron in its various forms—have each and all impressed upon the monuments of different nations the

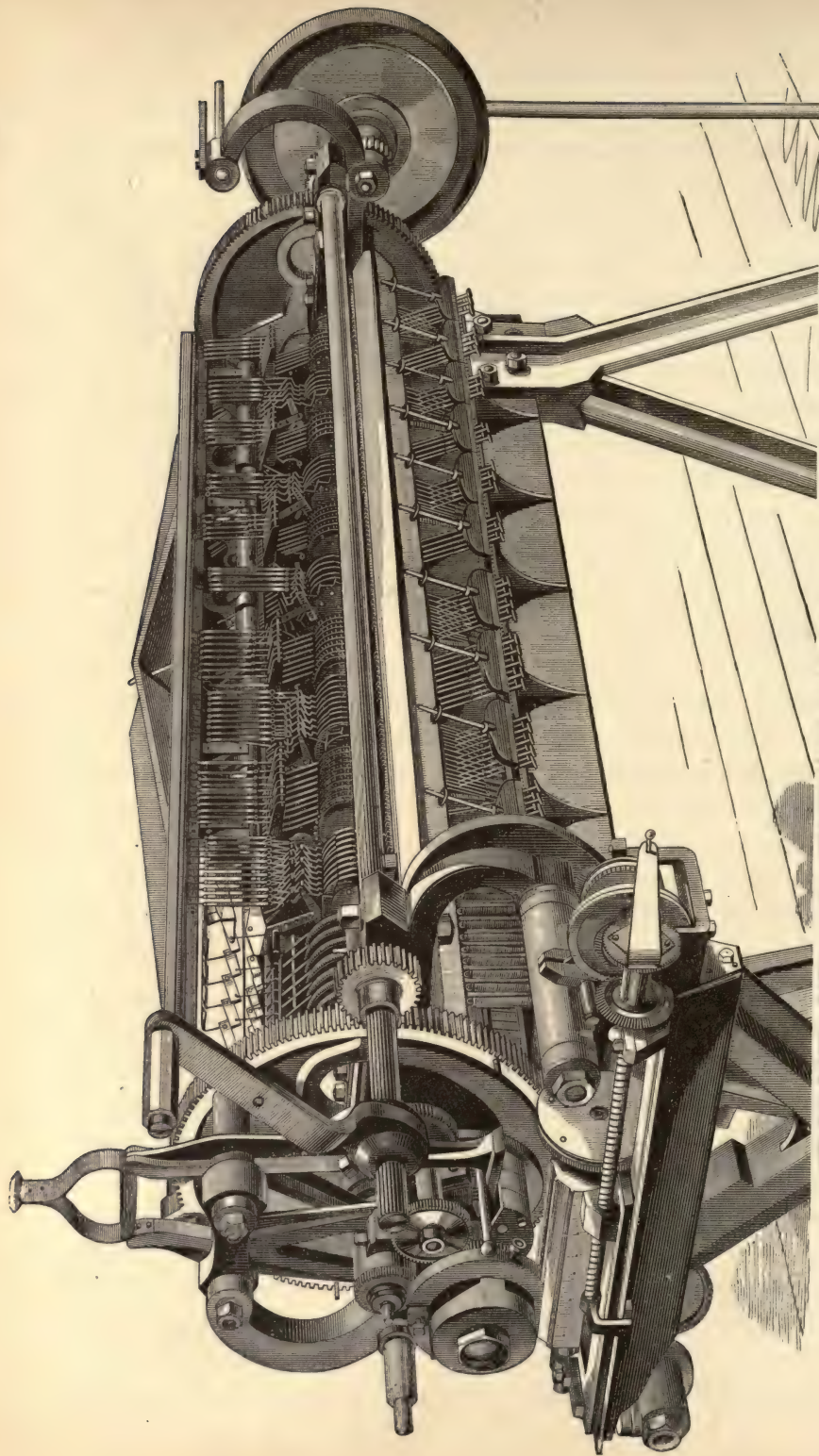
impossibility to fill them all alike, and the bricks in some are turned out imperfect. The extraction of the moisture in the clay before moulding also destroys its cohesive power, preventing complete fusion in the burning, and producing bricks unable to withstand the action of the weather. In the manufacture of slush-brick, the great amount of water that is used while exceedingly favorable to the production of good brick, is otherwise objectionable on account of the great length of time expended in the slow, outdoor process of drying, and the risk attended from unfavorable weather, as at least twenty-five per cent. of water must be evaporated from slush-brick, before it is safe to burn them. In work producing say thirty thousand of this kind of brick per day, it is stated upwards of twenty-three tons of water must be evaporated every twenty-four hours.

The present machine occupies a position between the "Dry Clay" and "Slush" machines, and may be designated as a Crude or Moist Clay machine, manufacturing to advantage with crude clay in a state so stiff as to require an evaporation of only about one-eighth that necessary with slush-brick before burning, and yet retaining all the cohesive qualities of the material. The brick, when burned, are of closer grain, less porous and, therefore, stronger and more durable than those manufactured by the other methods.

The engraving given on page 420 shows the general form of the machine. It is provided with a circular mould-table having an intermittent motion and containing eight sets of moulds, with four to a set, thus making in all thirty-two moulds. There are three distinct places for producing pressure on the clay in the moulds. The first is produced by a pressure-wheel from above, the second by a toggle-joint actuated by cams, and the third from above and below by toggle-joints and cams. The brick are delivered by sweep-motion on to an endless belt, or carrier. The moulds are of hardened steel and the balance of the machine is of iron worked up in a very solid and substantial manner. A ten horse-power engine, with one of these machines, will produce forty-thousand brick in ten hours, including the preparation of the

clay, which is performed by the same apparatus, although not shown in the engraving.

In a quiet corner of the Machinery Hall, just back of the exhibit of locomotive engines, stands a machine which at first sight would probably puzzle some of our best mechanics to give an opinion as to its use, and even then, would require a master-mind to analyze its mode of action. We refer to the Difference or Calculating Engine of George B. Grant, designed for the construction of large Mathematical Tables, such as tables of Logarithms, Sines, Tangents, Reciprocal, Square and Cube Roots, etc., and built for the University of Pennsylvania. All those interested in such subjects are familiar with the Difference Engine of the late Charles Babbage and its failure. Following him came George Schentz, a printer of Stockholm, whose machine, however, never came up to the full requirements of a difference engine, being of slow speed, sensitive and delicate in its details, containing radical defects in the theory of its mechanism and never reaching beyond the entrance to the goal for which its inventor contended. The subject was first taken up by Mr. Grant in 1869, when he was as yet entirely ignorant of the labors of Babbage and Schentz, and the year after, he prepared full drawings of his machine, but met with so much discouragement from those he consulted in the matter that the work was given up. In 1871, however, Professor Wollcot Gibbs—now of Harvard College—heard of his labors on the problem, and after a thorough examination into the subject, approved of the plans and gave so much encouragement to the inventor by his deep interest and constant efforts of support as to contribute largely to the final success that has been attained. After several failures to procure the necessary funds for expenses, a liberal subscription was made by the Boston Thursday Club in 1874, and the same year the means requisite for the construction of a large engine were furnished by Mr. Fairman Rogers, of Philadelphia, to whose munificence science is indebted for the machine now before us, which was finished only a few days before the opening of the Exhibition. When it is remembered how important



"The Great Exhibition, 1876."

CALCULATING MACHINE.

By George B. Grant.

By permission from Messrs. Gobbie & Barrie's "Masterpieces of the International Exhibition, 1876."

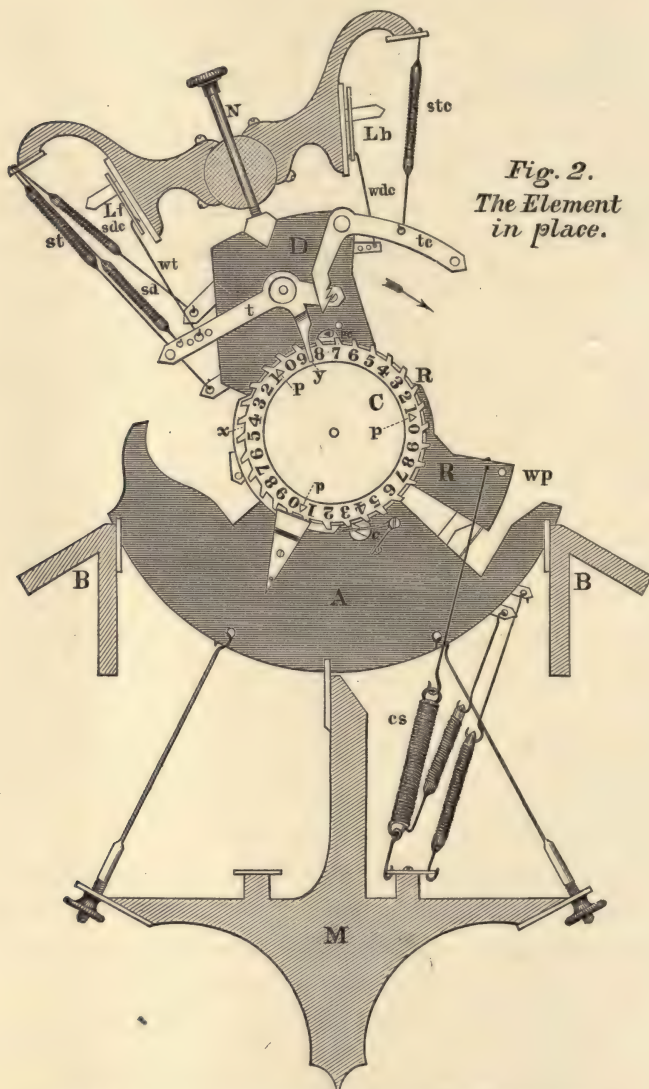
[Machinery Hall.

numerical tables are in practical applications of mathematics, and the great labor and time necessarily occupied in their calculation and publication by the usual methods, involving errors which it seems impossible to prevent, even with the greatest care and the most watchful proof-reading, the value of such a machine may readily be seen.

The accompanying engravings—shown on pages 424, 426 and 428—give a very fair idea of the apparatus. It occupies a space of about five feet in height by eight feet in length, and weighs about two thousand pounds, containing when in full working order, from twelve thousand to fifteen thousand pieces. The long body contains the calculating mechanism, while at the front end is an apparatus for printing a wax mould of the results, from which an electrotype may be made directly for printing, requiring no setting of type and no risks of error. The machine is driven either by hand, by a crank at the front end, or by a power appliance at the rear end. The calculating portion of the machine consists of a number of elements placed in a long frame side by side, each element representing one decimal place of the work, and there are from twenty-five to one hundred of these, according to the particular requirements of the problem in hand.

Figures 2 and 3—presented on pages 426 and 428—show front and rear views of an element constructed of pieces of sheet metal, all in the machine being alike and interchangeable. They are placed in the frame one-half inch apart from each other and arranged in groups, each group representing an order of differences. Referring to the figures, the portion A of the element is fixed and the portion D is a rocking arm revolving upon a bearing at the centre of the plate, C, and having its upper part—in the case of all the elements—fixed to a long frame, shown in cross-section in the figure at N, which is oscillated back and forth by the driving-gear of the machine. When this frame is moved forward in the direction indicated by the arrow, the arm of each element moves with it and adds to itself the figure that is upon the element of the same decimal place in the group or order below.

The pin, k, e, in the figure moves over the teeth of the wheel, C, until a proper point is reached, when it is released by means



VIEWS OF THE ELEMENT; CALCULATING MACHINE.

By George B. Grant.

of mechanism attached to the corresponding element in the order below and falls on to the cogs of the wheel, C, carrying it with

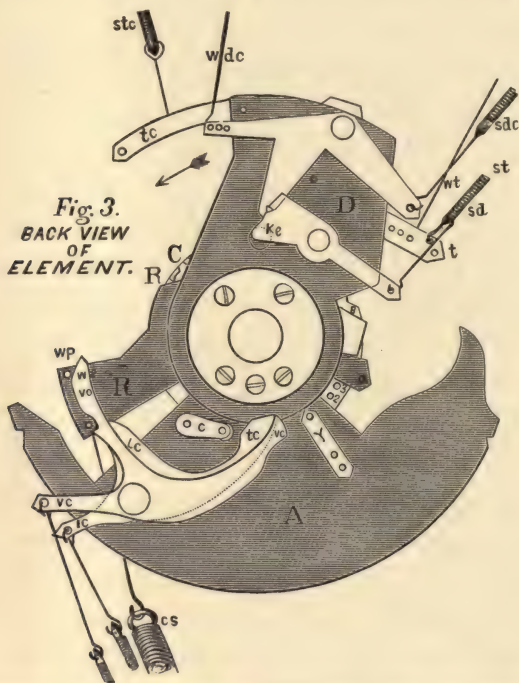
it in its forward movement until lifted out from the cogs by the riser at R. As it goes back it sends its figure up to be added to the element of the same decimal place in the next group or order above. The trip, t, striking one of the pins, p, draws down upon the wire, wt, and by means of a longitudinal lever, Lf, acts upon a wire that releases the driver, ke, of the element added to in the order above. (See Lb and wdc in the figures.) The action throughout is the same, each motion forward adding all the odd orders to the even ones, and each motion back adding the even orders to the odd ones and at the same time printing the tabular number at the front end of the machine, stamping it into the wax plate there for that purpose.

This machine possesses a very great advantage over any previous invention of the kind, in that any wheel may be connected so as to add its number to any wheel of the next higher order. In the machines of Babbage and Scheutz each element was arranged to add its figure to a given fixed wheel in the order above. With a given amount of mechanism, by means of this arrangement, this machine can accomplish work of three times the complexity of any former machine.

Many of the figures used in an operation are constant. Thus, the last order is constant at various values and many of the other elements are fixed at zero or at nine. To provide for this, each element carries a constant-wheel, consisting of a thin disk of brass, x, which turns on the bearing of the calculating-wheel, and being set at any figure by the spring and pin, y,—Fig. 2—allows the driver, k, e, to drop on the wheel at the same tooth each time and add a constant figure. Thus—see Fig. 2—if set at 8, there are 8 units added at each movement.

The operation of carriage, while simple as to mechanism, is exceedingly complex in theory of action, the apparatus for the same, although by far the most important part of any calculating-machine, being, nevertheless, the most difficult to contrive, and it was to this that Babbage's machine owed its failure, and Scheutz's machine its slow working speed. The riser, R, is hung on the

centre-pin of the wheel, C, and it falls as the wheel passes from nine to zero, throwing the driver, ke, out one space further on than otherwise would be done and carrying a unit to its wheel. This riser, R, is held up by two catches which are operated by the pins, p, p, p. On the next wheel below, one catch is drawn aside as the wheel passes from eight to nine and the other as the zero is reached. As the riser drops, a pin, wp, upon it strikes



VIEWS OF THE ELEMENT; CALCULATING MACHINE.

By George B. Grant.

and draws the upper catch of the next wheel above. The arrangement makes a perfect and simultaneous carrying apparatus, acting under any possible combination of requirements.

The construction of the printing apparatus is rather complex, as many conditions must be satisfied. Each of the upper ten calculating-wheels is connected by gearing with a die-plate, in the edge of which common printing type are set. While the machine

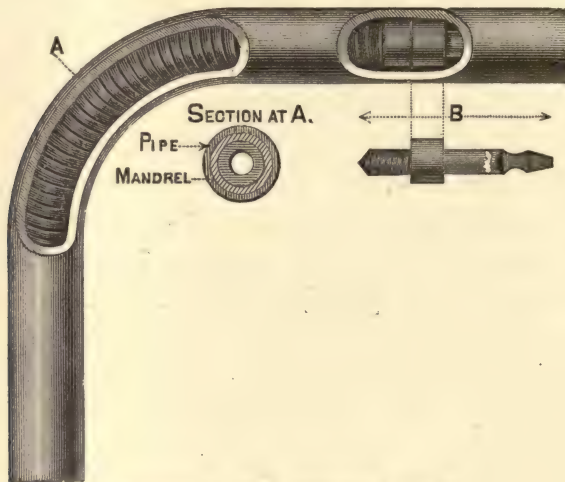
is in motion, these plates are separated slightly and work easily without interference with each other. When an impression is to be taken, they are brought closely and firmly together and a pair of plungers at the same time straightens the line of figures and presents it ready for the plate of wax below, which rises and receives the impression.

The terms of the table can be arranged in almost any way desired for printing, either each under the preceding, or before it, or they may be run across the page, as is generally done, and either forward or backward. It is also possible to adjust the distance between the lines and vary it from line to line as required.

When the machine is worked by hand, a speed may be made of ten to twelve terms per minute, and from twenty to thirty when by power by the attachment at the rear end. All that limits the speed is the imperfection of the mechanism, and in the case of the present machine—the first ever constructed of so complex a character—imperfections are to be expected which will not exist in future machines. Thirty of the elements of this machine were placed in a light wooden frame and worked successfully at a speed of over one hundred terms per minute, and if the whole machine were used and sufficient power applied, this speed would be perfectly practicable, provided that the mechanism of the driving-gear and printing apparatus were in accurate working order and made sufficiently strong to stand the wear and tear resulting from the same.

Mr. Morris L. Oram, of Philadelphia, exhibits a Flexible Mandrel for Bending Metal Pipe that has attracted considerable attention, being an exceedingly ingenious and novel arrangement of great value in its particular department. By the usual method of bending pipes they are first filled with melted rosin, some fusible metal as lead, or sand, so as to preserve their shape, requiring considerable trouble and care in cleaning out afterwards and making it a tedious, expensive and imperfect job at the best, requiring almost universally—unless with very small pipe—the use of the hammer and file to straighten the irregular crimps formed

on the interior curve of the bend. By this method, a mandrel is used, being a strong, closely wound steel helix, formed of square rectangular wire, and having a uniform external diameter such that it may fit easily in the pipe to be bent. A nut is fastened into one end of the mandrel into which a stem is screwed, which may be made of any length, for removing the mandrel after the work is accomplished. This is done by simply revolving the stem in the direction to wind up the helix, when its diameter is reduced, allowing it to be easily withdrawn, and the spring in the metal restores it to its original size after removal. If the



MANDREL, FOR BENDING PIPE.

By Morris L. Oram.

mandrel is not sufficiently long for the whole bend of the pipe, it may be moved from place to place as required, or reversed bends introduced, if desired, with the greatest ease. If the proper sized mandrel is not on hand to bend a given pipe, the next size smaller may be used without any appreciable error.

Large pipe can be bent as accurately and readily as small pipe, a matter of great difficulty by the old methods, and impossible when the pipe became quite large, requiring previous softening by heat, and resulting in elliptical, unequal and irregular shapes of cross-section that were exceedingly undesirable, the material at

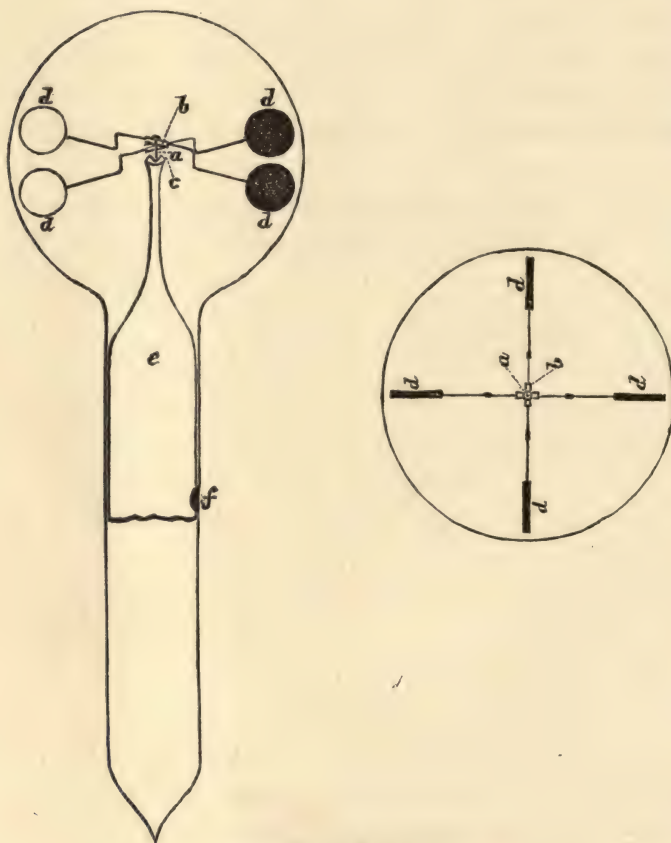
the outer diameter becoming very thin and weak. By this method, the pipe after bending has a practically uniform internal section without appreciable variation in diameters, a qualification that will be fully appreciated by the manufacturers of pneumatic dispatch-tubes, where this requirement is so necessary.

Mr. Oram has bent $\frac{3}{4}$ -inch butted zinc pipe to a curve of $1\frac{1}{4}$ inches radius, 1-inch pipe to 2 inches radius, and $2\frac{1}{2}$ -inch pipe to 5 inches radius. A 2-inch pipe has been bent to 4 inches radius, cold without any difficulty. Square pipe may also be bent as readily as round, and the process seems to supply a want long felt.

Mr. James J. Hicks, of London, England, exhibits a curious apparatus in the form of a Radiometer for demonstrating the mechanical action of light and the conversion of radiation into motive power, constructed according to the design of Mr. William Crookes, F. R. S., to whom is due the discovery of this force. Mr. Crookes' attention was first drawn to the matter from noticing that in weighing heavy pieces of glass apparatus in a vacuum, there appeared to be a variation in weight, corresponding to variations in temperature of the material weighed from that of the surrounding air and weights of balance. This led him to institute a series of experiments with very delicate forms of apparatus, and he discovered that there was a force depending upon the action of the light. In the case of an exceedingly fine and light arm suspended in a glass tube with balls of various materials at the ends of the arm, the whole being thoroughly exhausted from air, he found that on the approach of a heated or luminous body to one of the balls a very decided repulsion took place and an attraction if a cold body, such as ice, was used. He also ascertained that when the different rays from the spectrum were thrown on white and black surfaces there was a decided difference between the action of light and of radiant heat, dark heat having no perceptible difference of action on white or black substances, but luminous rays repelling black surfaces much more energetically than white. Acting upon these facts he designed and constructed

an instrument, completely and beautifully exemplifying the principles of his discovery, which he called the "Radiometer."

This instrument is shown below in section and plan by Figs. 1 and 2, and consists of four arms of some light material, to the ends of which are fixed thin disks of pith with one side black



CROOKES' RADIOMETER.

By James F. Hicks.

and the other white, the black sides for the four disks all facing the same way. These arms cross each other at right angles and are balanced at their centre points on a hard steel point, *a*, resting on a jewel-cup, *c*, so that they may freely revolve in a horizontal plane. A thin glass globe drawn out to a tube at the lower part

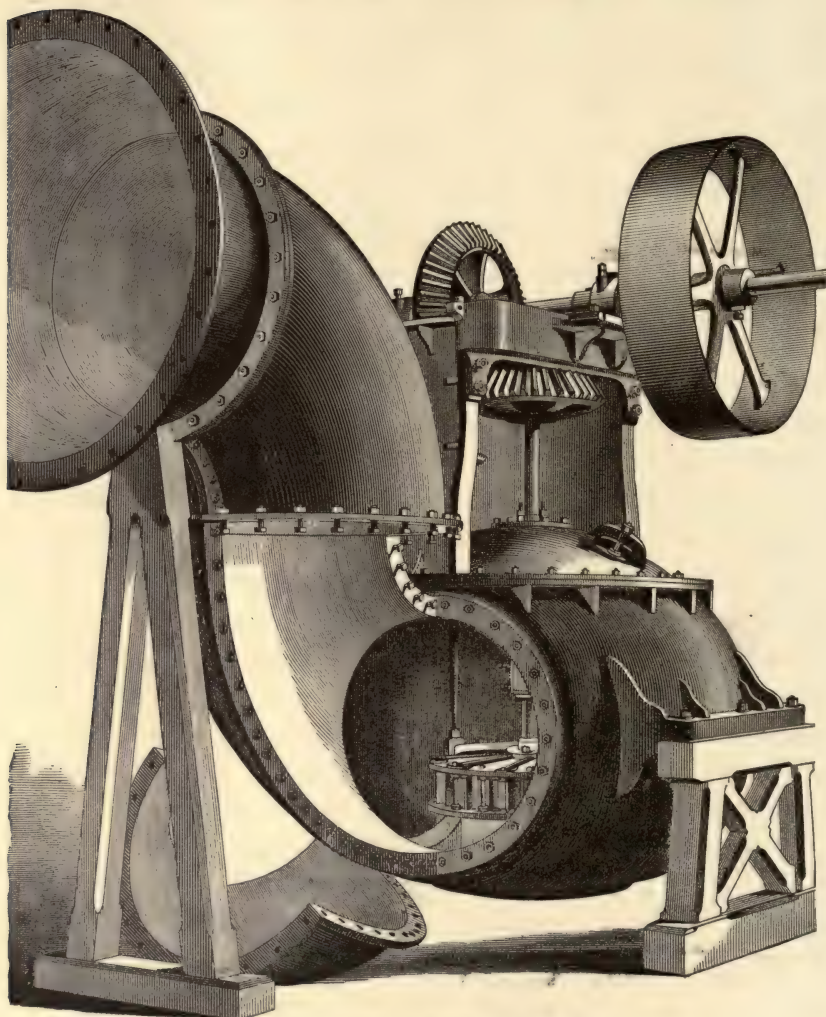
so as to form a support, encloses the whole and is exhausted to the greatest attainable vacuum and hermetically sealed.

When this instrument is placed subject to the influence of light, the arms rotate with greater or less velocity directly in proportion to the intensity of the incident rays, and in the case of very intense light, like that from the sun or burning magnesium, the rapidity of rotation becomes so great that the separate disks are lost in a circle of light. Experiments made by varying the distance from the source of light show that the mechanical action is inversely proportional to the square of the distance. Dark heat produces no rotation.

This new apparatus may be applied practically to a number of uses. A standard candle may be defined as one which at a given fixed distance causes a certain number of revolutions to the apparatus per minute, and comparison can readily be made between this standard and various other kinds of light, or these various kinds may be compared among themselves. The effects of light through different media can also be ascertained and the photographer may use this instrument to great advantage in his so-called dark-room to ascertain whether the light he is using is likely to injure his sensitive preparations or not. He can also measure the intensity of the light in his operating-room, and by means of one of these instruments instead of a watch, regulate the amount of exposure necessary for a subject with the greatest accuracy, working according to so many revolutions of the instrument independent of the time.

The discoverer has also very lately invented a torsion-balance by which he is enabled to weigh the force of radiation from a lighted body—as a candle—the principle being similar to that of Ritchie's torsion-balance, and fully confirming the previously ascertained law of inverse squares. By calculations deduced from an experiment with sunlight, it was demonstrated that the pressure of sunshine amounted to two and three-tenths tons per square mile. Mr. Crookes' discovery is one of great value, and promises to be the means of solving in future many problems, as yet unexplained, in the action of forces in our vast universe.

Messrs. Poole & Hunt, of Baltimore Md., exhibit several sizes of "Leffel's Patent, American Double Turbine, Water-Wheels;" and we present an engraving of one having a wheel thirty and



DOUBLE TURBINE WATER-WHEEL.

Messrs. Poole & Hunt

a-half inches in diameter, the largest shown, although the manufacturers make up to a diameter of ninety-six inches.

These wheels are exceedingly popular in the United States,

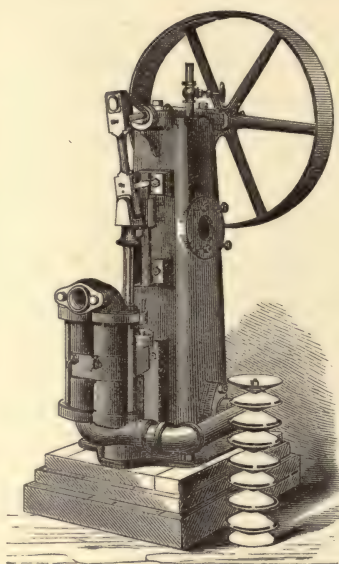
there being over seven thousand now in use, and the owners of the patent-right claim great advantages from the peculiarities of construction. The unsteady motion, variable speed and irregular quantity of water always obtaining in practical manufacturing operations, necessitate requirements in the construction of water-wheels that do not always show themselves in the usual test-trials, where every thing is arranged for the purpose, and it is claimed that the Leffel Double-Turbine meets just these points and possesses remarkable efficiency and durability under actual long-continued use. This Turbine belongs to that class in which the water enters at the circumference and discharges at the centre, and it has two sets of buckets on one wheel, one over the other, and each constructed upon a different principle. The upper ones curve only slightly downward and run in towards the centre of the wheel, having the faces at quite an angle to a radial line, while the lower ones curve down almost immediately and bend sideways in the direction of the circumference very considerably, before reaching the lower face. The upper buckets, therefore, receive a great side-pressure and the lower ones almost a vertical pressure. By this arrangement it is claimed that there is admitted to a wheel of any given size, the greatest possible volume of water, consistent with its economical use, and at the same time the greatest attainable area is provided for its discharge.

Movable guides around the outer circumference direct the water in to both sets of buckets, and these guides may be adjusted to any position at pleasure, even to shutting off the water entirely if desired; working by guide-rods and a segment of a toothed wheel running in a pinion regulated by a vertical rod convenient of access. The wheel is surrounded by an ample spherical cast-iron flume or penstock, seven feet six inches in diameter in the present case, furnished with a movable cap large enough to allow the passage of the entire wheel, if necessary, at any time for repairs, and also provided with man-holes. The penstock is attached at one side by a flange connection to a cast-iron supply-pipe, three feet eleven and a-half inches in diameter. The wheel is supported

at the foot of its axle by a hard-wood rest, set on end, and working with excellent effect.

It is claimed for these wheels that they give a maximum discharge of water with a minimum friction, and produce an actual work of eighty-five per cent. on an average of the absolute work of the fall. The cast-iron penstock presents great difficulties of construction, and has been executed in superior style, reflecting great credit on the makers. In fact all the parts of the machine have

been manufactured with great care and precision, this alone adding materially to its economy and efficiency; and the whole combination, in proportion and general mechanical arrangement, is first-class, well adapted to its intended purpose, and securing the best results, both in



HEATER AND FORCE PUMP.

By Poole & Hunt.

efficiency of action and durability under use.

We also engrave on this page a Patent Feed-Water Heater and Double Acting Force Pump, exhibited by Messrs. Poole & Hunt. In feed-water heaters as usually constructed, the exhaust steam from the engine is discharged into the

water and there permitted to escape; whereas in the present example the heater is simply connected by a branch-pipe with the exhaust in such a way that a sufficient volume of the exhaust steam is attracted into the heater to raise the feed-water to a temperature of 200 degrees without in any way impeding the free escape of the exhaust, or causing back pressure in the cylinder. The supply of cold water is admitted into the heater in a small but continuous stream, and flows over and through a series of disks set inside, but shown separately in the engraving.

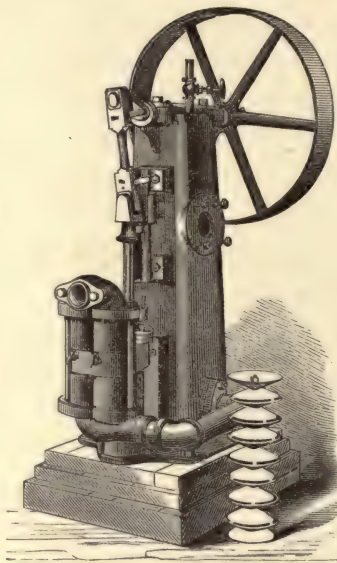
By the arrangement here adopted the condensation, refuse grease and other matter from the cylinder does not enter the heater, and is therefore prevented from access to the boiler. In the ordinary heaters, where the steam discharges directly into the water, these impurities are carried on into the boiler, forming injurious combinations, causing foaming, etc., and raising serious objections to the use of "open heaters" as usually constructed.

The provinces of the Netherlands from time immemorial have been obliged to contend with great difficulties from encroachments of the sea and from inland floods of the rivers. The waters of the North Sea, under storms in certain directions, are driven with great violence on the coast, and although in many places a natural barrier exists in the sand thrown up by the ocean, forming rows of hillocks, which give protection to the country back of them, yet at other places, and necessarily at the mouths of the rivers, this does not occur, and sea-walls or dikes of great strength have to be constructed to resist the action of the waves. On the other hand the nature of the country, consisting of vast areas of low bottom-land like that on the Mississippi, sometimes even twenty feet or more below the beds of the rivers, subjects it to great risk of overflow, especially in the spring of the year, when the upper waters, coming from more temperate climes, break up before a free passage has been opened to the sea, and accumulating, completely fill the channels of the rivers and spread over the country, carrying destruction in all directions.

The proper protection of Holland against these encroachments demanded the mutual coöperation of all the inhabitants, and therefore became a national undertaking, and resulted, after much trouble from want of union among the different provinces, in the establishment, in 1798, of what is called the Waterstaat, an organization clothed with almost absolute power, with authority to compel service from all sources if any sudden demand should occur for it, and into whose hands was intrusted the construction and maintenance of all hydrographical undertakings in the kingdom of the Netherlands.

at the foot of its axle by a hard-wood rest, set on end, and working with excellent effect.

It is claimed for these wheels that they give a maximum discharge of water with a minimum friction, and produce an actual work of eighty-five per cent. on an average of the absolute work of the fall. The cast-iron penstock presents great difficulties of construction, and has been executed in superior style, reflecting great credit on the makers. In fact all the parts of the machine have been manufactured with great care and precision, this alone adding materially to its economy and efficiency; and the whole combination, in proportion and general mechanical arrangement, is first-class, well adapted to its intended purpose, and securing the best results, both in



HEATER AND FORCE PUMP.

By Poole & Hunt.

efficiency of action and durability under use.

We also engrave on this page a Patent Feed-Water Heater and Double Acting Force Pump, exhibited by Messrs. Poole & Hunt. In feed-water heaters as usually constructed, the exhaust steam from the engine is discharged into the

water and there permitted to escape; whereas in the present example the heater is simply connected by a branch-pipe with the exhaust in such a way that a sufficient volume of the exhaust steam is attracted into the heater to raise the feed-water to a temperature of 200 degrees without in any way impeding the free escape of the exhaust, or causing back pressure in the cylinder. The supply of cold water is admitted into the heater in a small but continuous stream, and flows over and through a series of disks set inside, but shown separately in the engraving.

By the arrangement here adopted the condensation, refuse grease and other matter from the cylinder does not enter the heater, and is therefore prevented from access to the boiler. In the ordinary heaters, where the steam discharges directly into the water, these impurities are carried on into the boiler, forming injurious combinations, causing foaming, etc., and raising serious objections to the use of "open heaters" as usually constructed.

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The causes previously given, and the fact that the soil is



FIG. 1.



FIG. 2.



FIG. 3.



FIG. 4.



FIG. 5.

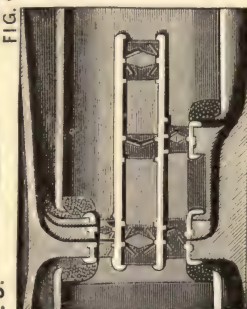


FIG. 6.

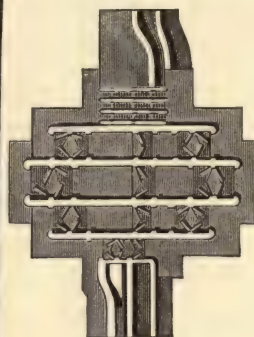


FIG. 7.

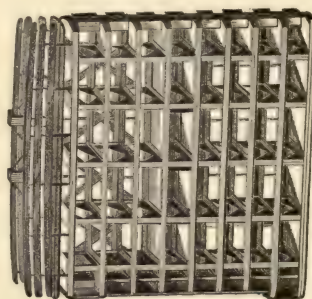


FIG. 8.

CANAL FROM AMSTERDAM TO THE NORTH SEA.

Fig. 1. Plan showing state of the work in 1872. Fig. 2. Plan showing completed work. Fig. 3. Section of dam across the Y below Amsterdam. Fig. 4. Section of jetty-walls at North Sea entrance. Fig. 5. Section of dam across the Y below Amsterdam. Fig. 6. North Sea Locks. Fig. 7. Zuyder-Zee Locks. Fig. 8. Lock-gate.

generally composed of a soft alluvium over sand of unknown depth, and also that the great sedimentary deposits brought

down by the rivers are continually acting to elevate them above their surroundings, have together resulted in a strong development of the principles of hydraulic engineering, and the actual execution of great operations in the reclamation of flooded lands, the opening of rivers to navigation, the building of sluices, locks, canals, the construction of difficult bridge foundations, etc.

In 1842 a Royal Academy for Engineers was founded at Delft, where scientific training was provided not only for engineers intended for the Waterstaat, but also for those proposing to engage in kindred pursuits of industry and trade. In 1860 the construction of all railroads came under the charge of the

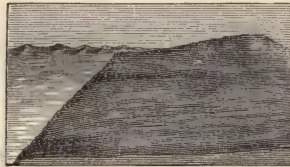


FIG. 9.

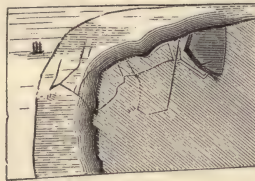


FIG. 10.

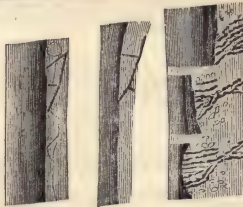


FIG. 11.

CANAL FROM AMSTERDAM TO
THE NORTH SEA.

Figs. 9, 10, 11 exemplify the denudation and protection of the sea-coast of North Holland.

Government, and the quarter century just past has been more prolific in bringing forward engineers of distinguished ability and in the completion of grand engineering works of most important character, than any previous period in the history of the country. The Department of Public Works of the Netherlands makes an exceedingly handsome display at the Exhibition, illustrating by means of maps, plans and models, its principal great works.

Among the first of these was the drainage of the lake of Haarlem, ordered on the 27th of March, 1839, and completed in 1852, at a cost of over four and a half millions of dollars. This lake had been formed by an overflow very many years before, and the present operation recovered some 42,481 acres of valuable land by the sale of which the entire expenditure was returned.

All that section of Holland surrounding and covered by the Zuyder Zee has been entirely changed from its original condition by the inroads of the ocean, which have occurred from time to time on a greater or smaller scale, and on record from the fourth century. The gradual formation of the Zuyder Zee itself has been due to

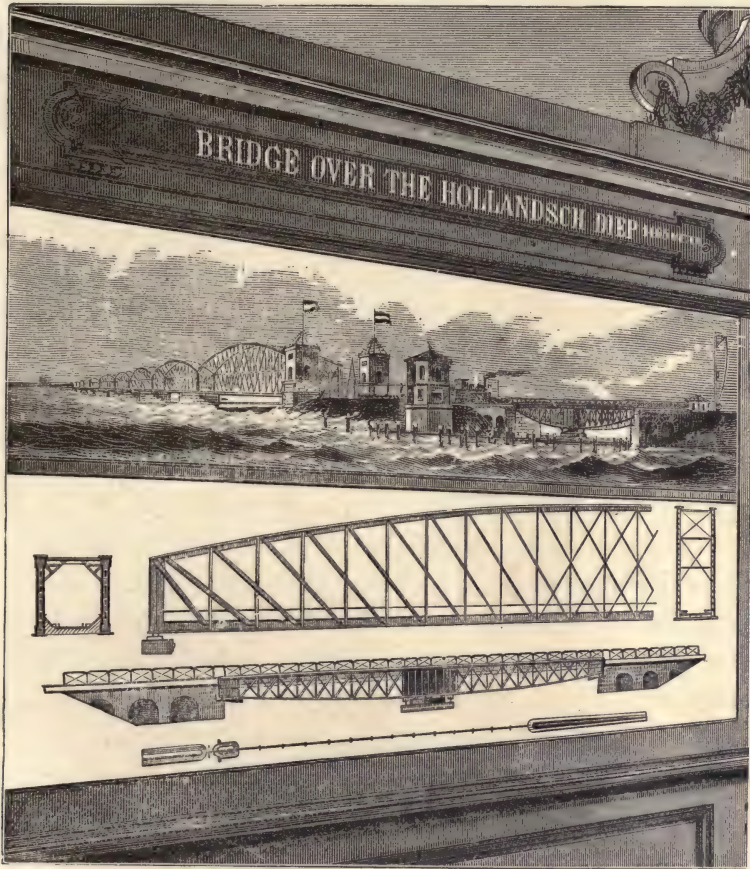


BRIDGE AT BOMMEL.
Department of the Netherlands.

this cause, the whole area having been at one time a fertile, well-cultivated country. A comparison of the two maps on exhibition, of Holland in 1576 and 1876, illustrates this very clearly. The question of the drainage of the vast area of this sea has also been taken up, and the investigations show that the work is

entirely practicable and can be carried out in from eight to twelve years' time.

Another important work has been the construction of the North Sea Ship Canal from Amsterdam, saving thirty-six miles in distance, and restoring a large amount of land from the waste



BRIDGE OVER THE HOLLANDSCH DIEP.

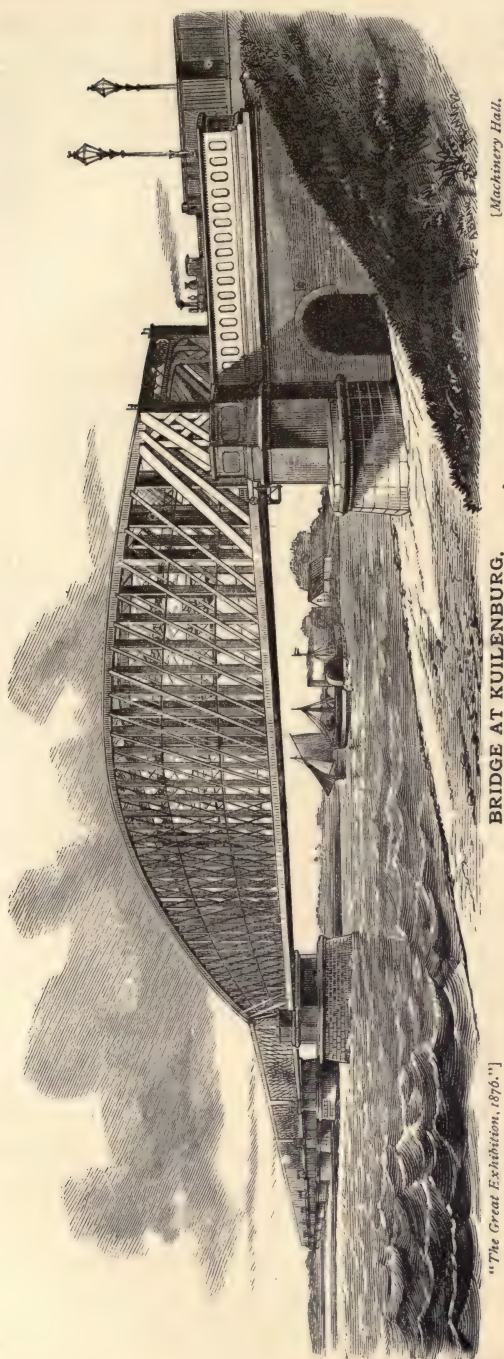
Department of the Netherlands.

waters of the Wijker-Meer and the Ij. The building of the piers or jetties for the North Sea entrance was effected under great difficulties, the treacherous sands of the coast rendering unsuccessful the method first adopted, of using heavy concrete blocks as previously carried out on the English coast at Dover, and requiring

considerable modifications of plan. The construction of the great embankment or dam across the Y below Amsterdam, from Schellingwoude to Paardenhock, a distance of three-fourths of a mile, rendered necessary in carrying out the project, and involving the building of a system of locks sufficiently large to pass the immense shipping business without allowing the barrier to be even *felt* as an obstruction, was one of the most important features connected with this undertaking, and it was here that the use of mattresses of fascine work, weighted with ballast stone, one of the peculiarities of dike construction in Holland, came so extensively into play.

Next in order came the project for the improvement of navigation from Rotterdam to the sea, by the selection of the most favorable of the numerous channels by which the Rhine, the Meuse and the Scheldt communicate with each other and discharge into the ocean, and by the introduction of lateral dikes, contracting the width where too great, or widening it where too narrow, so improving it as to allow the most effective action of the tides in removing deposits; also the formation of a new outlet to the sea by a cut through the Hoek van Holland and the building of jetties into the sea for the proper protection of its entrance from storms. The whole of this work involved great practical difficulties, and required engineering skill of the very highest order. It has been carried out with the greatest success, and rests, as is to be hoped, an enduring monument to those by whom it was undertaken.

The particular feature in the construction of the jetties has been in the use of the fascine mattress, a thing not before attempted in the opened sea, although very extensively used in dams and dikes obstructing or confining inland waters. The mattresses are made on the sea-shore between high and low water, so that they can be floated off to their final locations by the tide. Fascines are made from willow branches, osiers, etc., which are grown for the purpose as a regular business on the low lands of the estuaries of the rivers, the crop being cut every third or fourth year. The larger sticks are used for cask hoops, and the



[Machinery Hall.

BRIDGE AT KUILENBURG.

Department of the Netherlands.

"The Great Exhibition, 1876."]

smaller ones tied up into bundles, each bundle being made to contain at least three sticks, from ten to eleven and a half feet long, and two of six and a half to eight feet, the twigs and smaller branches remaining attached, and more being added if necessary to make up the standard size. The whole is bound together with two osiers, making a bundle about seventeen inches in circumference at the thick end, and fourteen at the other. Long ropes, called "wiepen," are made up with a series of fascines, each bundle bending well into the next, all firmly tied together, and making a rope of seventeen inches circumference. To build the mattress a series of these "wiepen" are first laid parallel to each other,

at distances apart of about three feet, and on top of these, at right angles to them, a second series, the same distances apart. These are then tied together at each crossing-point with two twigs, except those on the exterior lines and the alternate ones on the interior, which are fastened with tarred rope from old ships' cordage. The ropes are twisted upon small stakes, so that the ends may be used for tying upper wiepen to be mentioned hereafter.

A continuous layer of bundles of twigs is now laid upon the lower lines of wiepen, at right angles to them, covering the whole of the open spaces, the top ends of the twigs being upward, and the different bundles lapping partly over each other. A second layer is then placed over the whole at right angles to the first



DETAILS OF BRIDGE AT KUILENBURG.

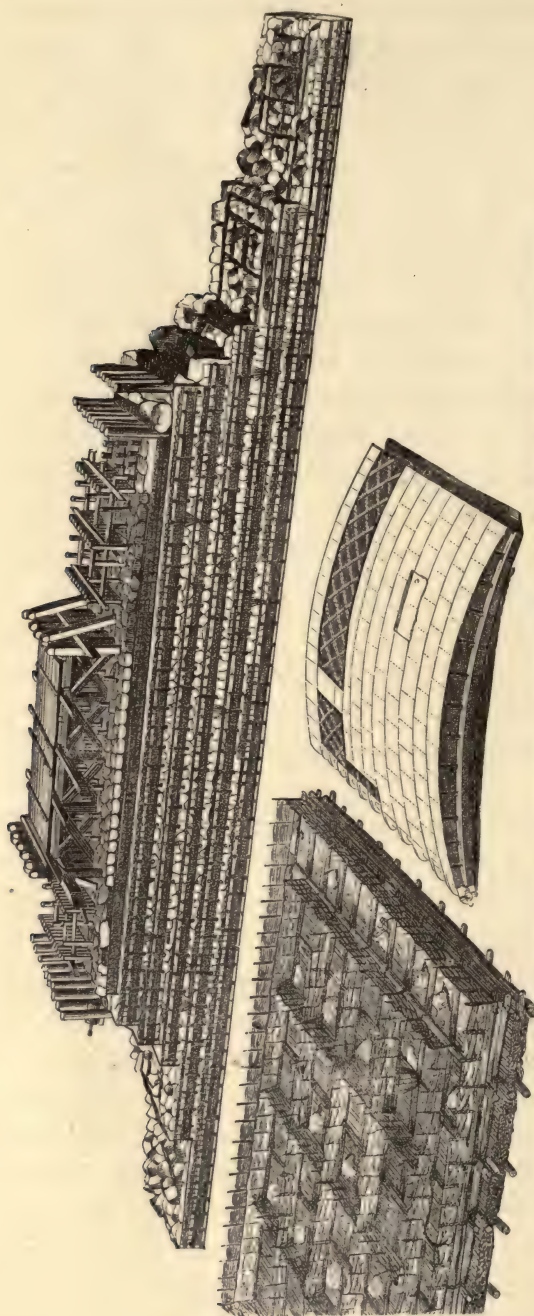
Department of the Netherlands.

and on top of this a third layer of the same kind, rectangular to the second. Wiepen are then placed at right angles in both directions directly over the lower wiepen, the small stakes at the corners fixing the locations of the cross points, and they are tied at the alternate crossings with the ends of the tarred ropes used for tying the lower wiepen, the whole being firmly pressed and held together.

The intermediate crossings are tied with twigs, as in the case of the lower wiepen, and the small stakes at the alternate corners are pulled out. The upper surface of the mattress is finally provided with divisions or cells to contain the ballast or broken stone necessary for sinking the mattress and holding it in position in the work. These are formed by driving stakes into the upper lines of wiepen, and weaving basket-work in between them with willow twigs up to a height of seven to nine inches, the

stakes being then driven down well into the mattress, leaving the ends about six inches above the willow-work. At the third and fourth crossings of the wiepen from the corners, and also at distances of about fifty feet from each other over the surface of the mattress a large stake is driven with some six or seven others in a sloping direction from the centre one, these being used to fasten the cables by which the mattress is conveyed to its destination and held in place while being sunk. Iron rings are also provided, fixed to cross points of the wiepen, so as to attach vessels by lines when the mattress is placed in position. The mattress is now towed to its position, and anchored as far as may be necessary, dependent upon the velocity of the sea; and small vessels of ten to fifteen tons are secured all around, filled with good supplies of stone. The pockets of the mattress are gradually loaded from the centre outward, and then more rapidly as it begins to sink, care being taken to let it settle evenly. At the proper time all ropes are let go simultaneously, the stone being thrown out as rapidly as possible, and the mattress finally sinks to the bottom. The ballasting proceeds until about three and a half to seven hundredweight of stone per square yard are deposited over the whole surface.

The work is built up in this manner, one layer of mattresses over the other, until the required height is reached. The head of the southern jetty has a width at the top of eighty-two and a half feet, the centre being three and three-tenths feet above mean low-water line. At the height of ten feet above that level is a platform of timber, supported on rows of square piles driven down through the whole construction, the outside rows being inclined and bolted at the tops to the adjoining rows. The platform has a width of about twenty-five feet, and carries a line of railroad track. The sides of the jetty are filled with large blocks of basalt stone set to a slope of one to one on the south side, and one and one-fourth to one on the north, the lower mattresses projecting from twenty-seven to thirty-three feet beyond the body of the work. The head is protected by two ranks of piles, bolted together at



DETAILS OF JETTY AT NORTH SEA—ENTRANCE OF WATER-WAY TO ROTTERDAM.
Department of the Netherlands.

the top, and two other ranks of shorter piles are driven in the stone-work as a protection around the outside of the whole.

The Utrecht Boxtel line of State railways in the Netherlands crosses three large rivers, the Lek, the Waal and the Maas, within a distance of ten miles, the bridges at these points being known by the respective names of the Kuilenburg, the Bommel and the Crèveœur viaducts. The great lengths of these bridges, the nature of the streams that they cross, and the local circumstances necessitated engineer-

ing skill of a high class. The conditions of the foundations were such as to require piling. The piles varied from twenty-three to fifty feet in length, being driven in some cases by the ordinary pile-driving engine, and in others by a steam ram. After the piles were cut off to a level below water, the space between them was filled with beton or concrete, projecting from three to five and a half feet beyond the footings of the masonry above, and varying from eleven to twenty-one feet in thickness. The tops of the piles were completely floored over, and masonry built up, well bonded on to the floors to prevent sliding by longitudinal and cross walings of oak, and the faces of piers and ice-breakers were finished in Belgian ashlar. The footings of the piers were thoroughly protected by a close row of long piles to each, and heavy rip-rapping of rough stone.

The superstructure of the Kuilenburg bridge was built by the well-known Dutch firm of Harcourt & Co., under the superintendence of Mr. N. T. Michaëlis, Engineer-in-chief. It consists of nine spans, entirely of wrought-iron construction, there being one span of 492 feet clear opening, one of 262 feet 6 inches, and seven of 187 feet each, making, with the widths of piers, a total length between the faces of abutments of 2181 feet. The bridge consists of two open trusses, built of riveted plates and angles, the upper and lower flanges being formed in the shape of double T's, side by side, the inclined ties of thin rectangular bars, except toward the centres of spans, where they require stiffening for compression under variable load, and the vertical struts of I-shape, some of the largest being strengthened by the introduction of two series of channel-bars between the verticals. The trusses are placed so as to give a clear width of roadway of 27 feet, and height of 16 feet 5 inches, the structure being a *through* bridge. Cross-girders 2 feet 11¼ inches deep connect the main trusses, and the whole is well stiffened by a thorough system of lateral and diagonal bracing. The span of 492 feet has a parabolic upper member, the depth of truss in centre being 35.6 feet, and at the ends 26.24 feet. The other spans have rectangular trusses of the same depth as the

ends of the parabolic truss. All holes for riveting were drilled, no punching being allowed in the work. The bridge is built for double track, there being only a single track placed on at present. Two foot-paths are provided for the service of administration. The total weight of material in the structure is as follows:—

Wrought-iron,	4394 $\frac{9}{10}$ tons
Bessemer steel,	610 $\frac{5}{10}$ "
Cast-iron,	30 "
Lead,	3 $\frac{3}{10}$ "

There were also 8000 cubic feet of oak, 9500 cubic feet of fir timber used, and 350 tons of plates placed between the rails to form the floor of the bridge. The total cost for masonry and superstructure was \$1,187,100.

The Bommel Bridge consists of eight land openings of 187 feet each, and three openings of 393 feet, making a total length between abutments of 2839 feet 7 $\frac{1}{2}$ inches. The Crèvecœur bridge has ten openings of 187 feet, and one of 328 feet, making a total span of 2346 feet. The superstructure of these two bridges is of the same character as that at Kuilenburg, except that the masonry is made for two separate single-track bridges, only one being erected at present, and an additional line of superstructure must be put up when double track becomes necessary. Curved upper members are used in the longer spans of both bridges. The weights of material at Bommel are—

Wrought-iron,	3468 $\frac{3}{10}$ tons.
Bessemer steel,	227 $\frac{1}{10}$ "
Lead,	2 $\frac{8}{10}$ "

the total cost being \$1,358,125 for masonry and superstructure.

The Crèvecœur bridge contained—

Wrought-iron,	2106 $\frac{8}{10}$ tons.
Bessemer steel,	84 $\frac{9}{10}$ "
Lead,	$\frac{5}{10}$ "

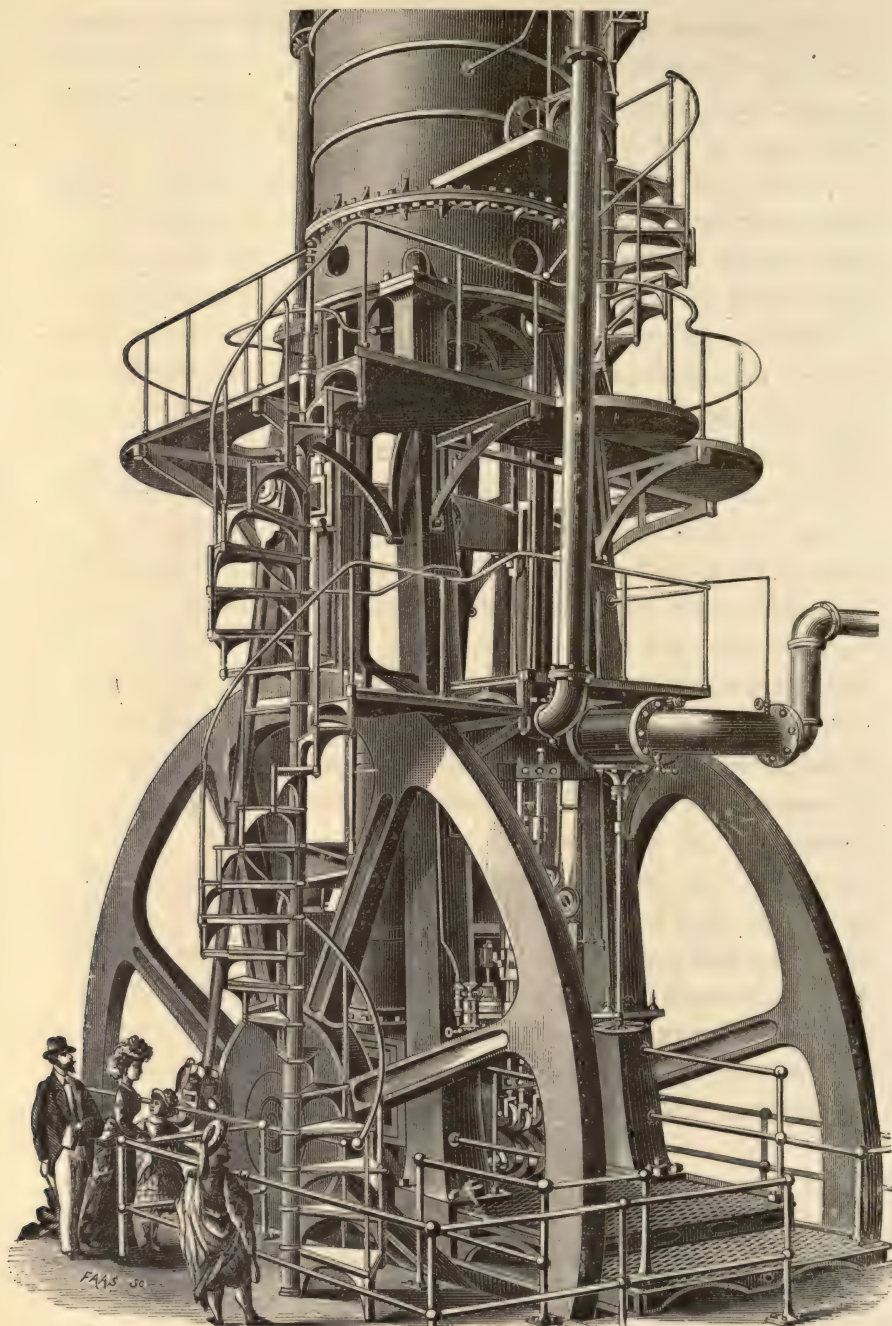
and cost \$465,000.

The whole of the iron and steel work in these bridges received six coats of best lead-oil paint after being cleaned in a bath of muriatic acid. The limiting strains for tension and compression were taken at $6\frac{1}{2}$ and $4\frac{1}{2}$ tons per square inch respectively.

Among the other noteworthy exhibits may be mentioned the bridge over the Hollandsch Diep, the steel bridge at Dordrecht, the swing bridge across the North Holland Canal, etc., and a handsome model of the Blanken lock-gates, used at a number of places in Holland. They are arranged by means of communicating ducts between the chambers of the locks and a recess into which the gates open, that the gates may be opened and closed simply by regulating the passage of the water through these ducts.

Prominent among the exhibits in the Machinery Hall, just west of the Corliss Engine, and towering almost to the roof, may be seen the Blast Engine of the I. P. Morris Company, of Philadelphia. This engine has been designed to meet the wants of American Furnace Managers, certain requirements having been laid down as a standard which the firm have endeavored to follow as closely as possible. These requirements are, "completeness without sacrifice of accessibility to the moving parts, self-adjustment of parts liable to irregularities of wear, and steadiness of the whole structure and preservation of alignment by being self-contained." The first engines of this class—a pair having steam cylinders forty inches in diameter, and blast fifty-eight inches, with a stroke of four feet six inches, and producing a blast pressure of twenty-five pounds—were built about eight years ago for Bessemer steel production. Since that time twenty-four, including the present engine, have been built and put into successful operation, showing that the efforts of the builders towards perfection of design have not been without their reward.

The firm construct engines on this plan with blast cylinders varying from seventy-five inches in diameter and six feet stroke to one hundred and eight inches in diameter and nine feet stroke, and nearly all of them are provided with condensing apparatus sufficient for initial steam pressure of forty pounds per square inch,



"The Great Exhibition, 1876."

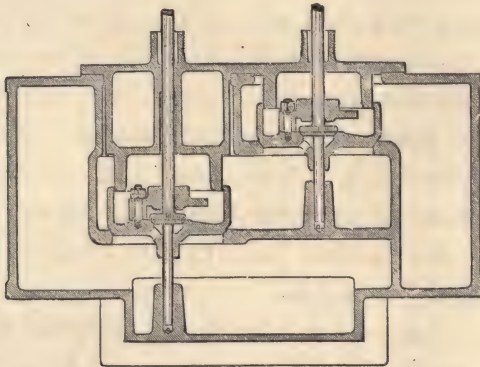
BLAST ENGINE.

[Machinery Hall.

By J. P. Morris Co. Philadelphia.

admitted during three-fourths of the stroke, and producing a vacuum of twenty-four and one-half to twenty-six inches. All parts are proportioned to the work of supplying steadily a blast of forty pounds pressure if required; and although this is beyond the ordinary working of anthracite coal-burning furnaces, it has been exceeded in one case, a pressure of thirteen and one-half pounds having been blown for a considerable time by one of these engines without causing it any injury.

The engines are fitted with the Wanich Equilibrium Valve, designed by Mr. A. Wanich, foreman of the machine-shop of the Company. The essential feature of this valve consists in the use



THE WANICH EQUILIBRIUM VALVE.

of a ring cast on the back of the main valve, extending upward and bored out so as to envelope and slide freely upon the outside of another ring cast on the steam-chest bonnet above, extending downward and turned off evenly on the outer circumference. These rings are of course concentric, and the annular space between them is quite small, very much less than the aggregate area of the holes for the passage of steam below the pilot valve, consequently any steam passing this annular opening when the pilot is raised, goes freely through into the cylinder, exerting no appreciable pressure on the back of the main valve, and permitting it to rise easily. This has been confirmed by connecting an ordinary steam-gauge with the space enclosed by the rings, showing the pressure, when

the pilot was seated, to be say thirty-five pounds, and dropping suddenly almost to zero when the pilot was raised, until the main valve opened, when it rose again to thirty-five pounds. This valve has been in use for about four years with highly satisfactory results, saving steam and proving easily manageable.

The blast-valves are of selected thick sole-leather, backed with plate-iron, and the blast-piston is fitted for either metal, wood or bag-packing. The steam-piston is provided with metal double rings held out by springs. The valves are lifted by cams operating directly against rollers fitted into the bottom ends of the lifting-rods, and these cams are adjustable but not variable, giving facilities for experimenting so as to determine the best distribution of steam without interference with each other. The cam-shaft is driven by spur-gears fitted to the main shaft. The rim of the fly-wheels on the side in line with the crank-pin is cored out, so that the excess of weight on the other side will counterbalance the weights of piston-rods, cross-heads, etc. The shaft is of wrought-iron, and the cross-head swivels in the yoke connecting the two piston-rods, so that it may accommodate itself to any irregularities of wear in the main shaft or crank-pins.

This particular engine has a height of thirty-six and one-half feet, weighs two hundred and fourteen thousand seven-hundred and ninety-four pounds, and exerts seven hundred and fifty horse-power, delivering ten thousand cubic feet of air per minute. The bed-plate upon which the whole construction rests is eight feet wide and thirteen feet long, weighs seventeen thousand pounds, and is laid on a foundation of hard brick or good stone at least ten feet in depth and well anchored to it so as to insure stability. The steam-cylinder is fifty inches in diameter, and the blast-cylinder ninety inches, the stroke being seven feet. The fly-wheels weigh forty thousand pounds each.

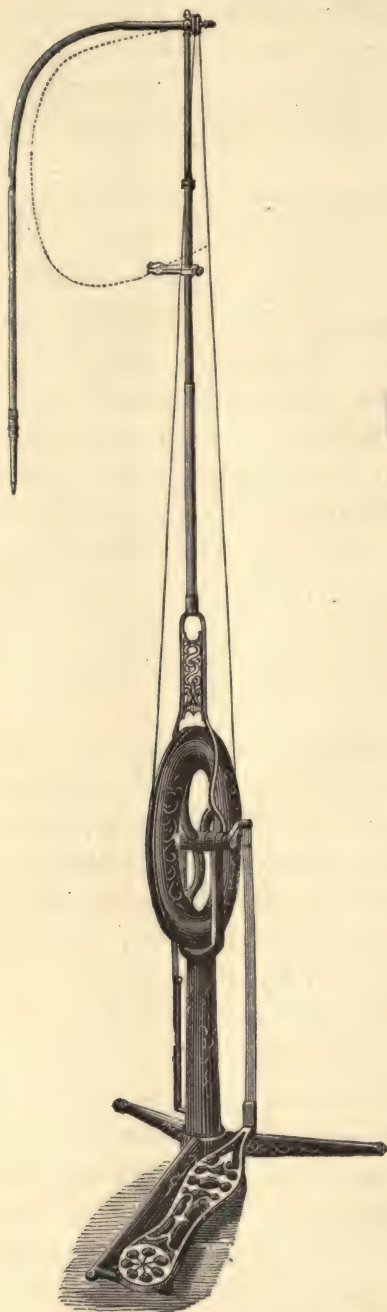
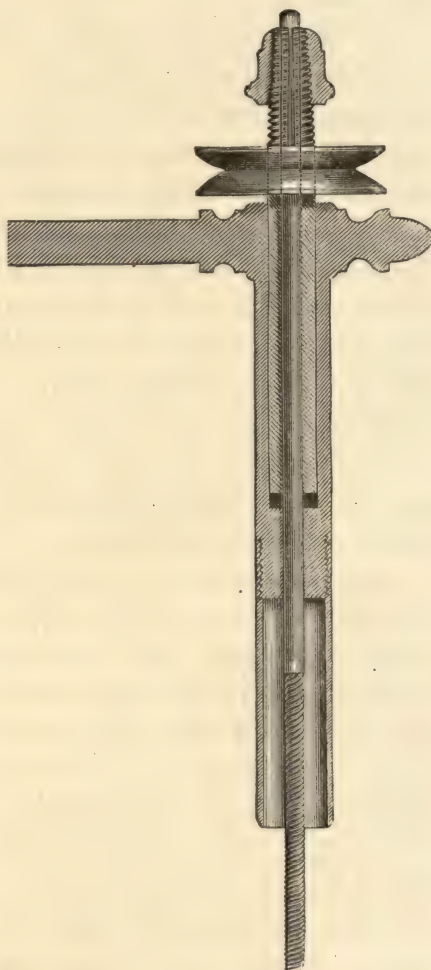
The height of the engine is principally due to the length of stroke, and this has been done so that a given quantity of air can be supplied by a less number of revolutions and with fewer beats of the blast-valves than is generally adopted in other engines.

The direct loss in delivery due to piston clearance and space in the passage being a quantity depending on the diameter of the blast-cylinder, then if we take a fixed diameter of cylinder, it is clear that the percentage of loss of useful effect will diminish as the stroke increases.

The engine is provided with a condensing apparatus situated just back of the main working parts, and in the entire construction everything has been carried out with a view to proper economy both in first construction and in future use. The firm claim for this style of blowing-engine, as compared with others, a reduced cost, not only of the engine itself, but also of the foundations required in setting it up, and the buildings necessary to cover and protect it when placed in working condition. Great advantage also results from the direct action of the engine, the power being transmitted directly from the piston-cylinder to the blast-cylinder without the action of a beam, as in many engines of this kind. The I. P. Morris Company have for many years been engaged in the manufacture of heavy machinery for iron blast-furnaces, and their exhibit does them great credit.

In the profession of Dental Surgery great progress has been made of late years in the introduction of machinery for the use of the practitioner. The manufacture of instruments, apparatus, furniture, artificial teeth, and dentists' materials generally, has been largely increased and developed, and one may now obtain at the dental depots, ready for use, all of the latest and most improved appliances required in this department of business.

Prominent among these establishments is that of S. S. White, of Philadelphia, represented by an exceedingly elaborate display in the Main Exhibition Building. We desire particularly to draw attention to the Dental Engine, exhibited by this house, as an exemplification of the modern application of machinery, and well illustrated by the accompanying engravings. By means of this engine all the operations of drilling, filing, polishing, etc., are accomplished with great saving of labor and time to the operator and of pain to the patient, affording better-shaped cavities than by

*Fig. 1.**Fig. 2.***DENTAL ENGINE.***By S. S. White.*

the old methods, and giving great facilities for furnishing the fillings and cleaning the teeth. It combines great steadiness of motion with ease and quietness of working, possessing at the same time elegance of construction and simplicity of action. It is operated by foot-power.

Fig. 1 gives a general view of the apparatus. The base is divided into three feet, well spread out and making a firm support. To one of these feet, lengthened for the purpose, is attached the foot-pedal, which connects by a flat steel spring, called a pitman, with a steel crank, moving a driving-wheel, which is supported by a post rising from the centre of the base and forked so as to provide bearings for its axle-shaft. Above the driving-wheel is an upright rod, the lower portion formed into a yoke passing over the upper part of the wheel and hinging on to the journal-bosses of the axle-shaft, thus making what may be termed a rocking-arm. Its primary statical condition is assured in an upright position by a prolongation beyond the axle-shaft of that arm of the yoke on the opposite side of the crank and the attachment of a spiral spring with its lower end fastened near the base of the apparatus. A screwed extension-joint and jam-nut are provided in the vertical rocking-arm, by which it may be lengthened and the driving-cord tightened if necessary. To the top of the rocking-arm is fixed a right-angled head-piece, shown in detail by Fig. 2, the horizontal part of which is drilled to receive a stem, upon which is fastened a pulley by a squeeze-nut on a conical screw. This pulley is driven by a cord passing around the driving-wheel, and revolves the stem, the other end of which connects with the rotating shaft of a flexible arm. The head-piece is pivoted and has free horizontal motion, and the arm is flexible at nearly every point in its length of twenty-six inches, being a rotating spiral within a fixed spiral sheath. The hand-piece is fastened to the end of the flexible arm, and the tool fits in to a tool-holder or chuck, being held by a simple yet perfectly satisfactory arrangement, revolving with the chuck without any vibration, and easily removed in a moment if a change of tool is required.

A large variety of tools is provided for this machine, such as excavating-burrs, drills, burnishers, finishing-burrs, corundum points, boxwood disks, wood-polishing points, etc., and a right-angle attachment is also furnished, which can be fixed to the hand-piece and is of great advantage in certain operations.

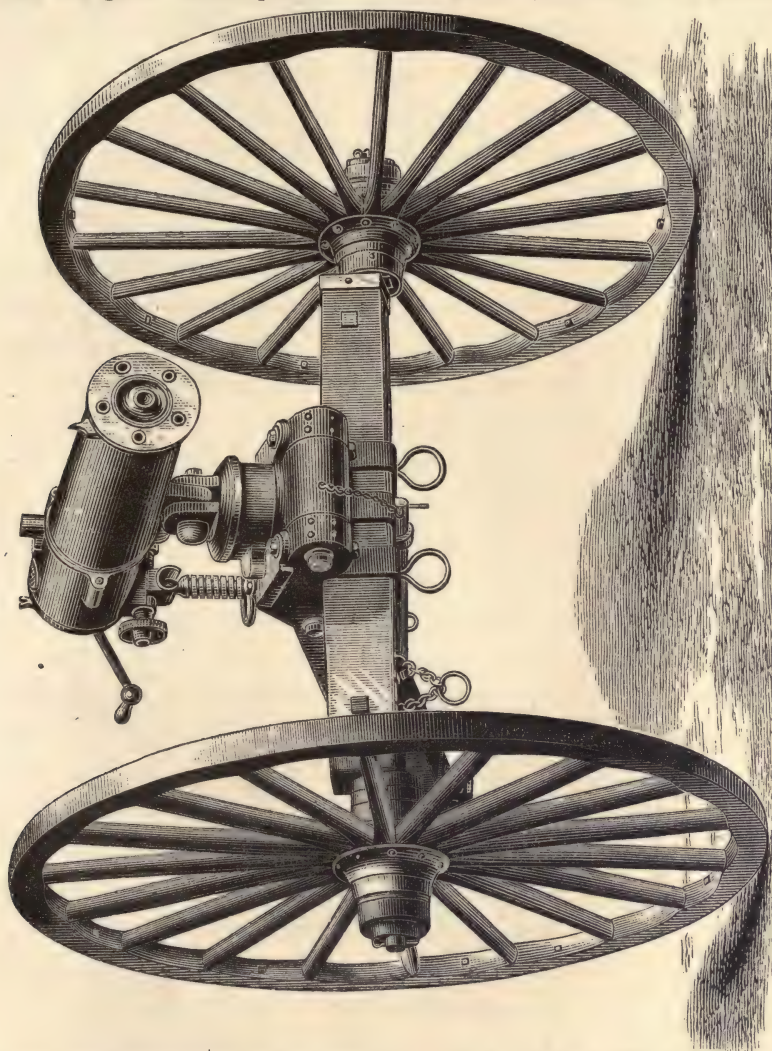
By means of an extension-treadle the operator can produce motion from either side of the patient's chair without moving the machine. An air-injector apparatus is also provided, consisting of a rubber bulb or bellows, which is compressed automatically by a simple mechanism connected with and working by the driven pulley. The air is forced from the bulb through a connecting rubber tube to a fixed nozzle at the hand-piece, from which it is thrown into the cavity of the tooth under operation, keeping it clear of burr-dust and cuttings and also keeping the bit cool.

The spring pitman which connects the foot-pedal with the crank is one of the novelties of the machine, giving the crank, when on the "down centre," an upward or live motion, and allowing the performer to operate with perfect ease. It is set at such an angle as always to keep the crank off the dead centre, being adjusted to throw it above its centre and allow greater length of turn in starting from rest.

The pivoted rocking-arm with its return spring always recovering the perpendicular when let free, constitutes another important novelty, affording the operator greatly increased freedom of motion and practically nullifying the tremor which always obtains in rigid machines, and communicates itself to the tool even with the greatest care, raising a fatal objection to their use. The flexible working-arm is also a special feature, bending, curving and yielding to every motion, and allowing the operator a freedom of touch which he could not possibly have with a rigid arm.

The Gatling Gun Company, of Hartford, Connecticut, exhibits in the Main Building a number of specimens of its famous Gatling Gun, invented by an American, Richard Jordan Gatling, in 1861-62, and after extensive trials, adopted into the service of our own Government as well as by most of the civilized nations of the world.

There are two styles of gun on exhibition, the original type as first constructed and a new design but recently brought forward, which possesses many advantages in arrangement of details over the old gun. Descriptions of the original type have been published

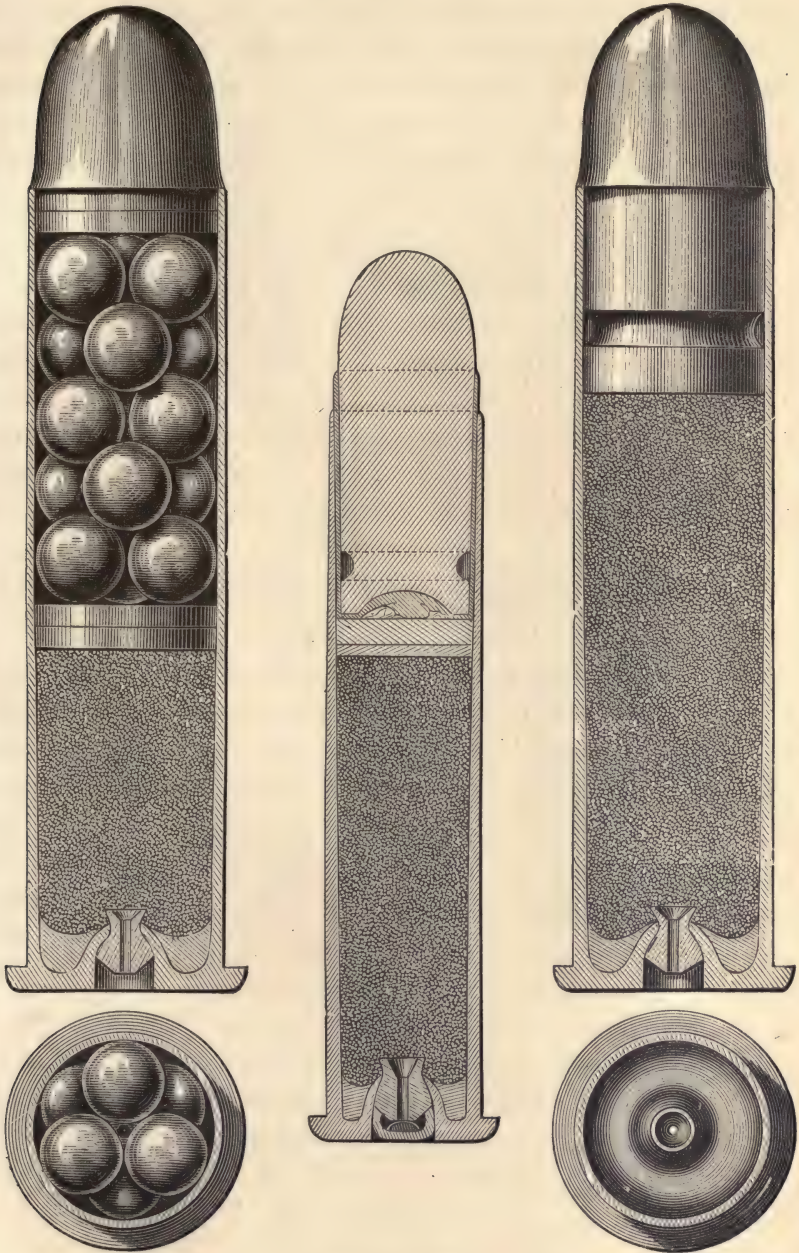
**GATLING GUN.**

By the Gatling Gun Company, Hartford, Connecticut.

and are accessible to the reader. It is of the new gun that we propose to speak.

The gun, as illustrated by the engraving on this page, consists of five parallel breech-loading rifle barrels, open from end to end,

and grouped about a central shaft to which they are rigidly connected by forward and rear disks or plates. The breech of each barrel is chambered to receive a flanged centre-fire metallic-cased cartridge. The shaft extends back some distance in the rear and immediately behind the barrels a cylinder of metal, called a carrier-block, is fastened to it, having on its exterior surface five semi-cylindrical grooves, cut parallel to its axis and forming trough-like extensions to the barrel chambers. These are to take and guide the cartridges into the barrels, and also to receive and discharge the empty cases after they are fired. A prolongation of this cylinder back forms another cylinder, called the lock-cylinder, which carries, in prolongations from the cartridge grooves, five long breech-plugs or locks. A breech-casing, rigidly connected with the gun-carriage by a screw by which the gun may be elevated or depressed, covers the lock-cylinder, and through the centre of the back plate of this breech-casing the rear end of the shaft is journaled. A cylindrical envelope covers the group of gun-barrels from muzzle to breech, and it is attached to the gun-carriage on the lower side by a vertical joint. The front end of the shaft with the front barrel-plate revolves within the end of this cylindrical envelope. A hand-crank is attached directly to the rear end, by which the shaft with its group of barrels, the carrier-block and the lock-cylinder, all rigidly connected with it, may be freely revolved. On the inner face of the breech-casing is arranged a truncated, wedge-shaped, projecting, annular or spiral cam, inclined back both ways from a flat portion, the apex of the truncated wedge pointing towards the barrels, and against this cam the rear ends of the breech-plugs or locks bear, being held in place by a lug from each, working in a groove at the base of a cam. Each lock has in it a firing-pin operated by a spiral main-spring. The firing-pin projects at each end beyond the lock, the front end being a point, and the rear end being finished with a knob, which at a certain stage in the revolution of the shaft is drawn back by a groove in which it works, and then suddenly released, causing the front to enter the cartridge and explode it. The



CARTRIDGES.

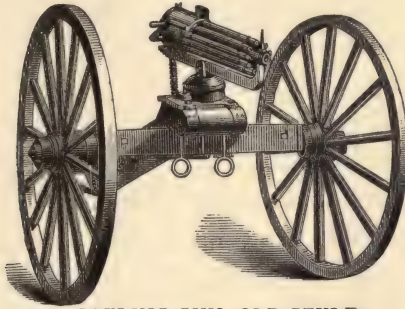
By the Gatling Gun Company, Hartford, Connecticut.

breech-casing extends over the carrier-block, covering it, except a

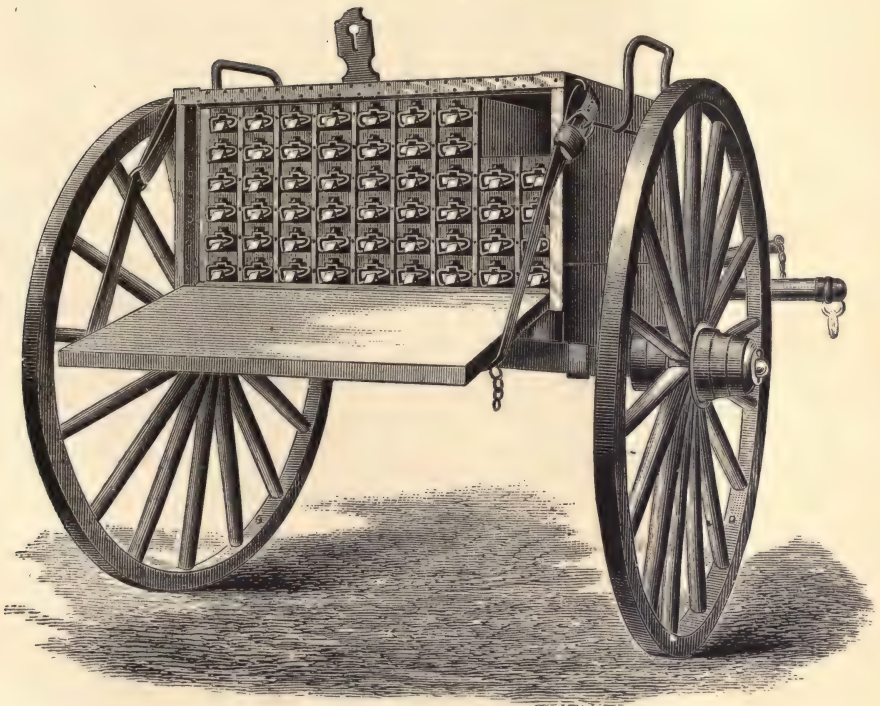
portion from near the bottom upwards on the left side, where it is opened, so that discharged cartridge-cases as withdrawn from the barrels may drop out on the ground. In the top of this casing is an opening, placed in the correct position and of the proper size, for a single cartridge to fall through into one of the channels of the carrier-block when it revolves underneath. The upper part of this opening is formed into a hopper, to which can be attached a cartridge or feed-case, holding a number of cartridges, lying in single file, one above the other. The cam in the rear of the locks is so arranged that each lock, when it gets in position behind the cartridge-hopper, is drawn back to its full extent so as to admit a cartridge in front. The action is as follows: Turning the crank, the shaft and its appurtenances rapidly revolve. Cartridge after cartridge from the feed-case drops into its respective receptacle in the carrier-block as it comes under the hopper. As each one passes on in revolution, the lock behind it, being pushed by the inclined cam, follows it up, thrusting it into its barrel, and, just before the shaft has reached half a revolution, drives it home and closes the breech. At this moment the firing-pin, which has been drawn back, is released and fires the cartridge, the reaction being resisted by the lock. The lock, still revolving onward, now begins to withdraw, and a hooked extractor attached to it, which had previously caught over the flange of the cartridge, draws the shell out, dropping it on the ground. By the time a complete revolution is accomplished, the lock is back again all ready for a fresh cartridge in front. The gun thus fires each barrel only once in a revolution, as many shots being fired in one turn as there are barrels. The working is very simple. One man turns the crank, and another supplies the feed-cases, one after another, as rapidly as exhausted, and the operation proceeds indefinitely.

The gun is mounted on wheels in the same way as ordinary field-pieces, or it may be placed on a tripod. In addition to the screw before mentioned for elevating or depressing the breech, there is also an adjustable arrangement at the rear, by which a limited angular movement in a horizontal plane may be given to

the gun if desired. This operates very prettily by the centrifugal force from the turning of the handle, making one movement back



GATLING GUN, OLD STYLE.



LIMBER CARRIAGE.

By the Gatling Gun Company, Hartford, Connecticut.

and forth for each turn, the handle moving in an ellipse instead of a circle.

The details of construction in the new gun have been very much modified from those in the old type, resulting in great simplicity of assemblage and more substantial design, greatly increasing its endurance. The gun is very easily taken to pieces for cleaning or repairs by merely removing the nut at the rear, when the crank can be taken off, and part after part removed, the whole coming to pieces. By this nut, also, which is a set nut, an adjustment can be made at a moment's notice, in the length of the spaces for the cartridges, to accommodate the breech-chamber to cartridges from different manufacturing establishments which often differ considerably in thickness of head. In the old type of gun this adjustment was a matter of considerable trouble, and had to be made at the front end. A great improvement has been effected in the new gun in the ejecting of the locks. By opening an aperture in the back plate of the breech-casing, they can easily be drawn out with the finger. If one gets out of order, it can be taken out and the firing proceed without it, there being however one shot less for each turn, and one cartridge falls to the ground undischarged.

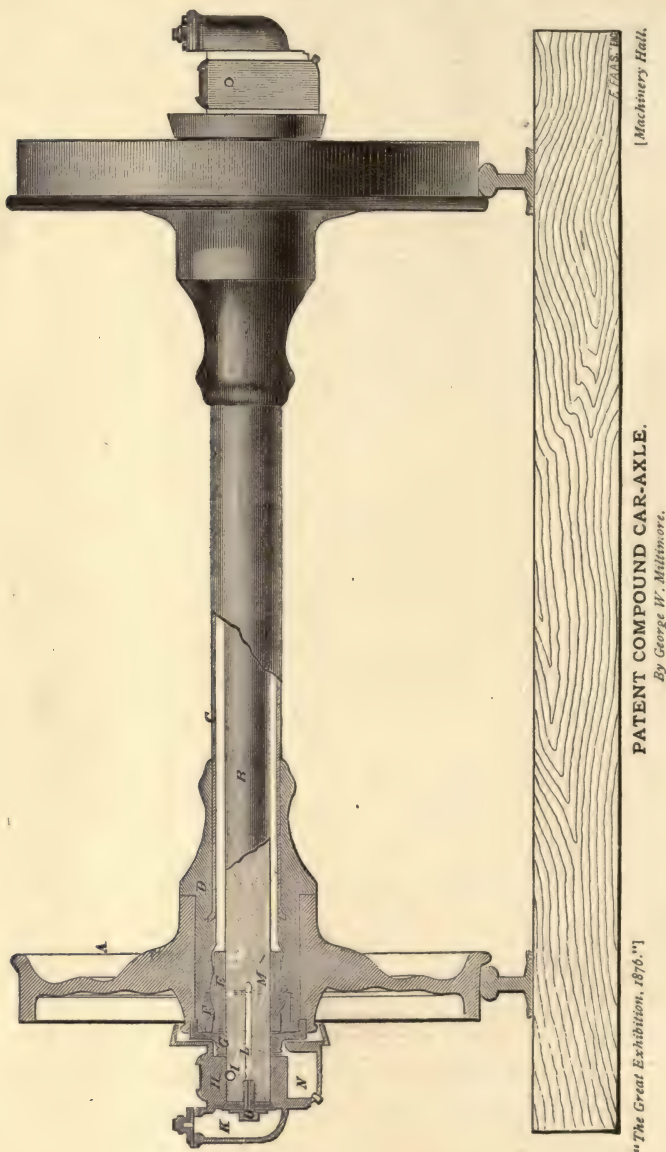
The arrangement of direct-acting crank from the rear, and the placing of the hopper exactly on top of the gun, at the same time improving its shape, so that cartridges may fall quickly by gravity without the necessity of forcing, has greatly increased the rapidity of firing, the new gun being capable of firing up to twelve hundred shots per minute, whereas the army reports claim only about four hundred and fifty shots per minute with the old gun. The new type of gun is very light, weighing only ninety-seven pounds, and it can easily be carried on mules or horses over rough country and operated at short notice.

Guns are made of 0.42, 0.43, 0.45, 0.50, and 0.55-inch calibre, and the larger calibre have an effective range of over two miles. The gun is reported by a Board of the War Department as "capable of maintaining uninterruptedly for hours a most destructive fire at all distances, from fifty yards up, being beyond all question well adapted to the purposes of flank defense at both long and short ranges."

The Miltimore Car Axle Company, of New York, exhibits a patent Compound Car Axle, the invention of Mr. George W. Miltimore, which it is claimed fully meets the difficulties experienced from the sliding of wheels on the rails, whether caused by curves, irregularities in the track or differences in the circumference of wheels, and inseparable from the use of the ordinary rigid axle. The improvement commences with a radical change from the ordinary arrangement, in that the axle is kept stationary while the wheels revolve, thus eradicating at once all tendency to torsional stress. The axle, which may be either of steel or cold-rolled shafting, is of the same size throughout, and passes at each end into a cast-iron pedestal-block, in which it is firmly secured and rendered immovable by a horizontal steel bolt passing through both axle and block. The axle is encased in a loose revolving sleeve of wrought-iron pipe, having cast-iron ends, on which seats are formed for the wheels, which are loosely mounted, each wheel being held to gauge on the inside by a shoulder in the casting, and on the outside by a cast-iron nut screwed to the end of the sleeve and fitting against the hub. Oscillating cylindrical boxes of brass fit in between the sleeves and the axle, forming the only points of contact, the bearing surface being on the under side. These boxes are made with a curved bearing on the outside to allow them to adjust themselves freely to the spring of the axle, and thus insure a perfect bearing on the interior for the whole length of the box, and avoid wearing at the ends. A box-ring fits closely to the outer half of the curve, and the sleeve-casting is turned to fit the inner half, sufficient room being left at the ends for oscillation.

The action of the device is as follows: When drawn forward, the wheels in moving, although loose on the sleeve-bearings, carry the sleeve round with them, the friction being much greater than on the axle-bearings; and on a straight track with wheels of the same diameter there is no motion whatever on these outer bearings. When, however, owing to the slightest curve, or an irregularity of track or other cause, one wheel is required to move faster than the other, instead of sliding one wheel, as is the case with the ordinary

arrangement, either wheel is perfectly free to accelerate or retard its motion independent of the other, according to the space over which

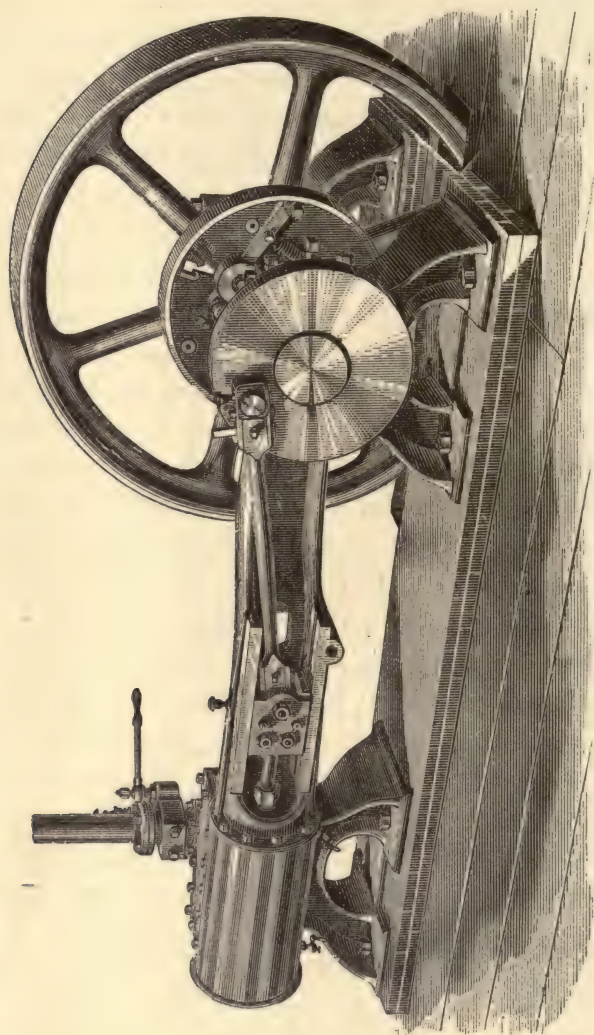


it has to move. No tensional strain can be thrown on the sleeve, for if a wheel should be forced slightly out of the perpendicular, as when

the flange strikes the outer rail of a curve and thereby cramps the hub on the wheel-seat, it at once turns the sleeve with itself and gains the necessary increase in motion at the opposite hub, where there is no cramp.

It is claimed that the following advantages are gained by the use of this axle: A reduction in power required to haul the train, consequently a saving of fuel; increased durability to wheels and axles; saving of wear on road-bed; increased comfort and safety to passengers; great economy in lubrication; freedom from hot boxes; less expense for repairs; and ability to use wheels of larger diameter. The results of practical experiments which have been made on the Vermont Central and other railroads for considerable lengths of time would seem to justify these claims, and there were seven cars equipped with these axles in daily service on the West End Passenger Railway in the Exhibition Grounds, operating with great success. Trucks with these wheels have been running on the Vermont Central and on the Chicago, Dubuque and Minnesota Railroad for a considerable time, and the results give a durability of, at the very least, double that of the rigid wheels. The Miltimore wheels, after a service of sixty thousand miles on roads of heavy curvature, show exceedingly light flange wear, evincing an equivalent saving of wear on the rail. It is stated that axles now in service, running fifteen months, at a rate of one hundred and fifteen miles per day, have consumed but one pint of oil per month, and when grease is used the saving is still greater. In addition to this, the use of cotton-waste is entirely dispensed with. A great advantage exists in the facility with which a wheel may be changed and a new one substituted, should the breaking of a flange or any other cause require it. Two men with a jack can easily remove a wheel and replace it in a short time without disturbing the car. The removal of the torsional strain from the axle affords greatly increased safety to the train and also allows the use of larger wheels, resulting in a smooth, even motion to the car and saving in power to draw the train. A fast passenger-train of five cars with forty-inch wheels has been running on the Vermont Central Railroad from one hundred and

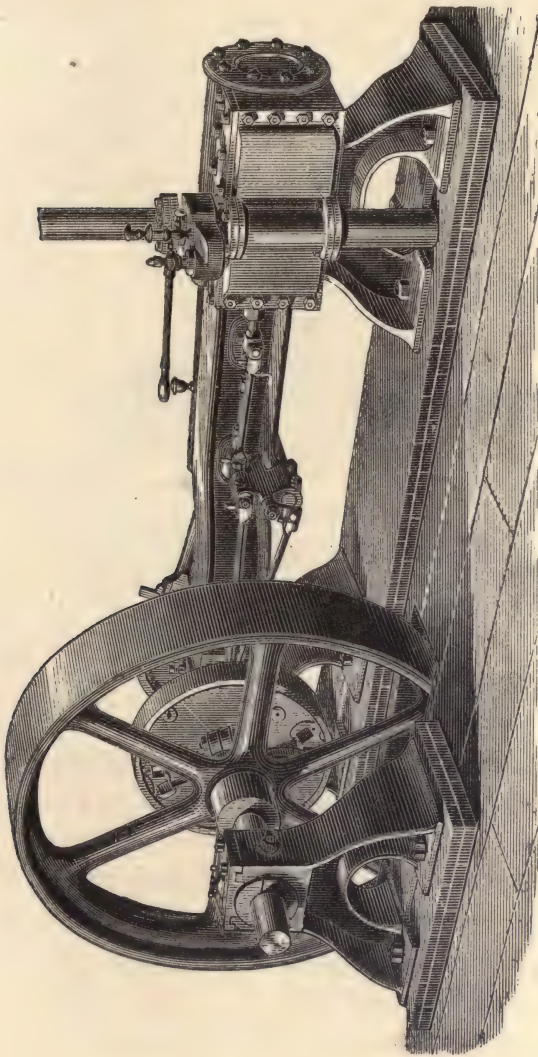
fifty to two hundred miles per day for eighteen months with great success. The wheels being triply cushioned, the hammering so destructive in the case of the ordinary axle is very much reduced.



AUTOMATIC GOVERNOR CUT-OFF ENGINE, FIG. 1.
By Buckeye Engine Co.

Even if an axle should break, the sleeve acts as a protection, and it would be almost impossible for the wheels to get out of place. If all that is claimed for this axle continues to bear the test of practical use, it is destined to effect an entire revolution in railway equipment.

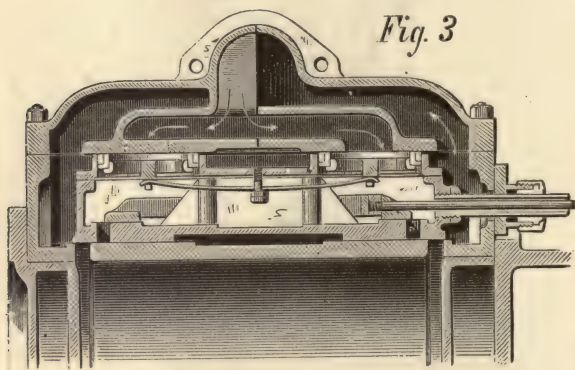
The Buckeye Engine Company, of Salem, Ohio, exhibits one of Thompson's "Automatic Governor Cut-off Engines," as manufactured at its establishment, which deserves close attention from all those



AUTOMATIC GOVERNOR CUT-OFF ENGINE, FIG. 2.
By Buckeye Engine Company.

interested in the economic application of steam. The consideration of this subject involves an important principle in the use of steam expansively, the energy being much more effectively given out for

the same amount of force, exerted on the piston of an engine, if the steam be used expansively at a high pressure, than if worked full stroke on an average pressure, and less steam required for the same work in the former case than in the latter. Of course, taking the same pressure of steam in both cases, more work can be obtained with full stroke pressure than with expansion, but it is at a waste of steam, and the question under consideration is to do the amount of work required with the greatest economy. Where the cost of fuel is no object, certain reasons may make the use of the ordinary engine working at full stroke, preferable, but these need not be considered



AUTOMATIC GOVERNOR CUT-OFF ENGINE. FIG. 3.

By Buckeye Engine Co.

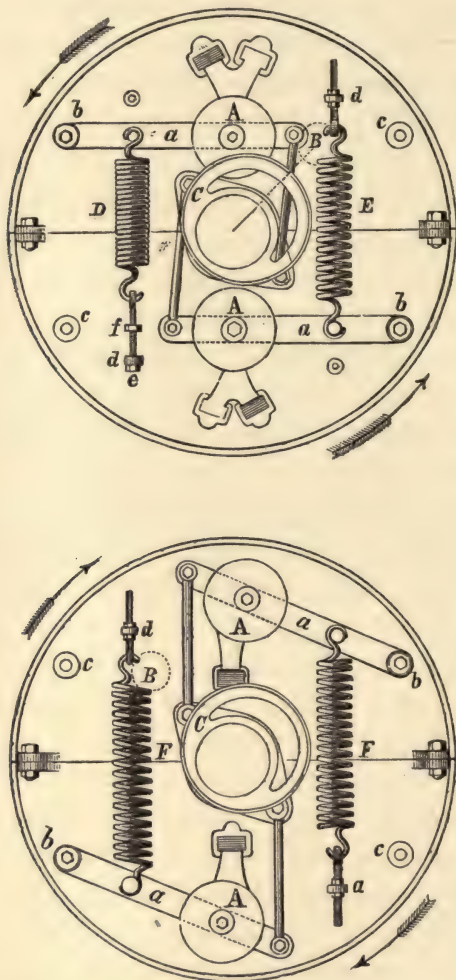
here. An important advantage in expansive working also obtains in wear and tear, the shocks and jars to the engine being much less than if worked with full stroke pressure.

In the case of the ordinary slide-valve, working with a continuous motion, there appears to be great difficulty in securing all the advantages of a cut-off, it being impossible to give a full flow of steam and a sudden cut-off. The maximum of economy requires a full boiler pressure to be carried into the cylinder at the commencement of the stroke, and maintained up to the point of cut-off, and the cut-off to be sharp, without causing a gradual reduction of the steam-pressure by what is called wire-drawing. Various methods have accordingly been adopted by means of valve gear, of holding the valve wide

open, and suddenly closing when required by a spring. The Corliss Engine is an example of a very successful method of accomplishing this object. In the case of the engine under consideration, the slide-valve is operated full pressure at full stroke, and a secondary valve is called into action at the proper time, to cut off the steam quickly from a full pressure to zero. When this valve is so controlled by the governor as to cut off the steam earlier or later in the stroke as required, and maintain a certain desired uniform speed, under variations of load and steam pressure, it becomes an Automatic Cut-off, and as such it is represented in this engine, the action being very different from the wire-drawing or throttling engine, where the governor performs its duty by throttling the steam more or less, on its passage to its work in the main steam-pipe.

Our illustrations, Figs. 1 and 2, engraved on pages 466 and 467, show front and rear views of the engine on exhibition, it having a horizontal action, with a cylinder of sixteen inches bore, by thirty-two inches stroke. The principle involved in the automatic cut-off appears to be the only true one for the highest economy in the use of steam; it remains that the practical application of it shall be properly carried out. It is claimed by the makers of this engine that it satisfies all the conditions necessary for this economy, and at the same time is so simple in construction, as to be very little more expensive in cost than an equally well designed throttling-engine, while it may safely be placed in charge of any fairly intelligent and careful engineer. The peculiar points of the engine are the slide-valve and the governor. Fig. 3, which we engrave on page 468, gives a section of the former. This slide-valve is in reality a small moving steam-chest, into the interior of which, the entire supply of live steam is admitted and passes from thence to the cylinder by ports near its end which are made to coincide alternately with the cylinder ports. The exhaust steam from the cylinder passes out into the steam-chest at the end of the slide-valve and follows on by ample passages to the exhaust-pipe, going downward freely and directly out of the way, and avoiding, even at the highest speed, that back pressure so often caused by the tortuous passages so common in

many other valves. The indicator-cards which have been taken of the working of the engine show with what perfection the valves perform all their functions. The arrangement gives great advantages in



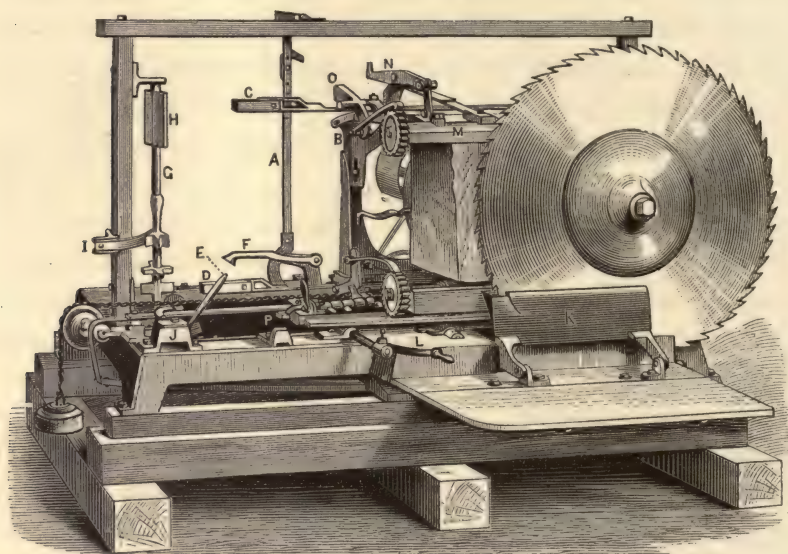
AUTOMATIC GOVERNOR CUT-OFF ENGINE, FIGS. 4 AND 5.

By Buckeye Engine Company.

allowing the face of the valves to be placed as close to the bore of the cylinder as a proper consideration of thickness of metal, for strength will permit, and by this means reducing the clearance or

waste room to a minimum. The openings in the back of the valve admitting the live steam are fitted with self-packing rings, so as to insure a steam-tight connection, and the area of these openings is made as small as possible consistent with the proper holding of the valve to its seat, making it as nearly balanced as practicable or desirable. By removing the top of the valve-chest which contains only exhaust steam, the working of the valve may be seen, and any leakage detected and remedied. The main valve is operated by a fixed eccentric, and the cut-off valve works inside of the main valve, the stem passing through a hollow main valve-stem, and is operated by an adjustable eccentric, through the medium of a compound rock-arm device and connections, as seen in Fig. 2. A small rock-shaft works in a bearing in the main rock-arm and moves with it, making the movement of the cut-off valve relative to its seat in the main valve, just the same in reference to both time and extent as would occur if the valve worked in a stationary seat and was attached directly to its eccentric. The main valve eccentric rod works horizontally and the cut-off eccentric rod inclines downward, so that its attachment to its rocker-arm is on a level, or nearly so, with the centre line of the main rock-shaft. The cut-off eccentric is automatically adjusted by means of two weighted levers connected with springs and contained in a circular case fastened on the engine-shaft. This regulator or governor is illustrated by Figs. 4 and 5, which we engrave on page 470, the former showing the position of parts when it is at rest, except spring D, which is not adjusted, and the latter showing their position when the engine is at its maximum speed. It must be stated, however, that the two figures are for different governors and adapted to run the engine in opposite directions, one being in arrangement the reverse of the other. It will be noticed that extra holes, c, c, are provided in the case so that the same governor may be changed in arrangement in a short time, to allow the engine to be run either way as desired. When the speed of the engine becomes too rapid, the centrifugal force overcomes the resistance of the springs and throws the levers outward, advancing the eccentric forward on the engine shaft and making an earlier cut-off. When

the speed is reduced, the springs draw the levers in and make a later cut-off. Fig. 4 shows the position of parts for the latest cut-off, and Fig. 5 that for the earliest cut-off. Set screws are provided to allow adjustment of the tension on the springs, which may be varied to suit the character of the work for which the engine is required. The makers claim great simplicity of parts, a reduction of noise in working to a minimum, very little clearance or waste room in the ports, close governing power and great economy of steam, also full opened



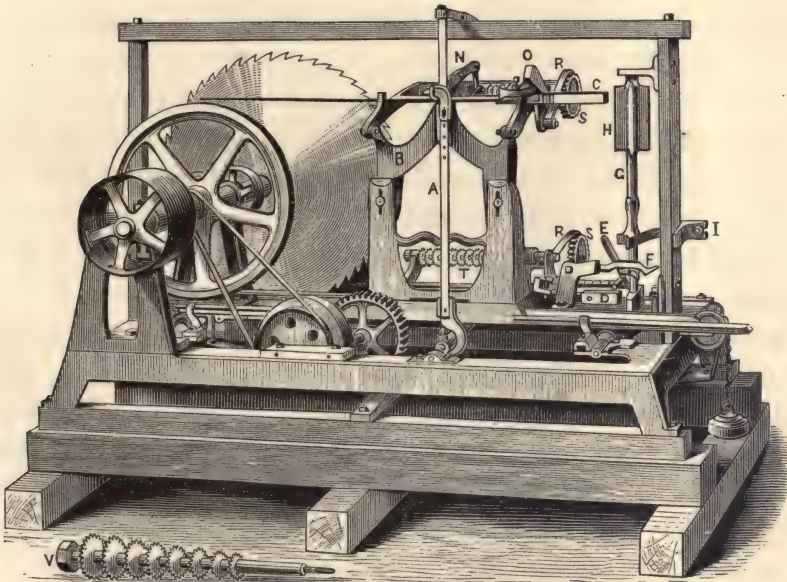
SHINGLE AND HEADING MACHINE.—FRONT VIEW.

By Buckeye Engine Company.

indication ports for all points of cut-off, and a free and unobstructed exhaust.

The Buckeye Engine Company also exhibits one of J. R. Hall's self-acting Shingle and Heading Machine, of its own manufacture, which appears to possess considerable merit, and to fully meet all requirements of the trade. Our illustrations, shown on pages 472 and 473, present front and rear views of the machine, and show its manner of construction. The cutting is done by a circular saw driven at a rate of thirteen to fourteen hundred revolutions per minute, an automatic device feeding and returning the block of

timber under operation, and throwing it back and forth, so as to cut alternate butts and points, while at the same time a simple and easily operated mechanism permits two or more butts or points to be cut in succession, if desired, and allows the rift of the timber to be kept vertical and in line with the saw, the sawyer having absolute control of the work. The machine may be adjusted in a few minutes to saw shingles of different thicknesses or different lengths without changing the uniformity of the taper or the evenness of the butts and points.



SHINGLE AND HEADING MACHINE—REAR VIEW.

By Buckeye Engine Company.

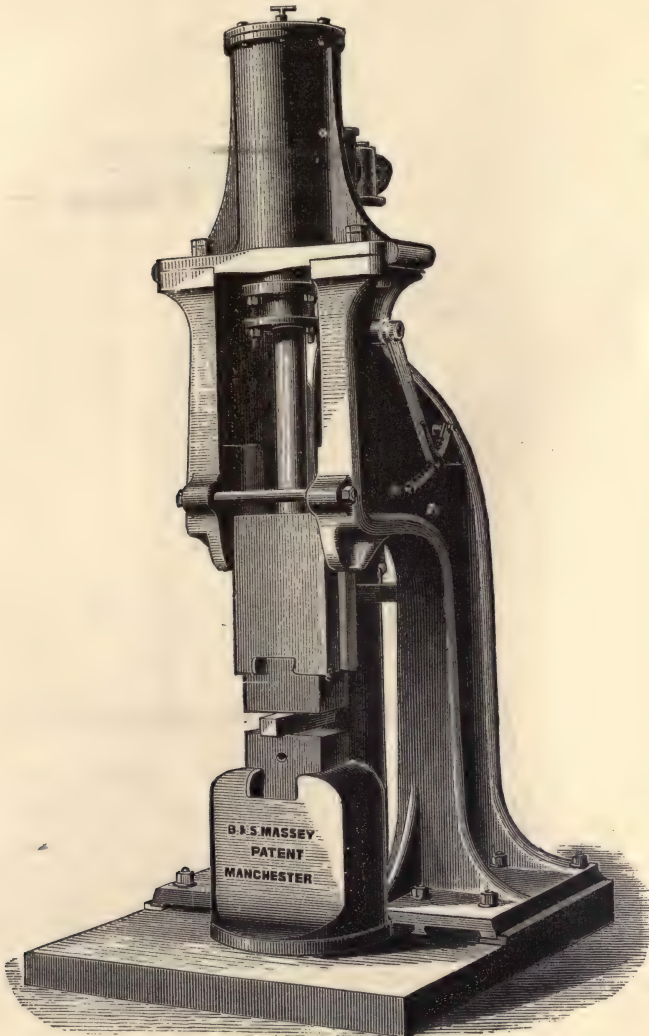
It may also be arranged to cut parallel headings without interfering in any way with its excellence as a shingle machine.

Two sizes of machines are built, one varying from fourteen to twenty inches in length of shingle, with widths up to fourteen inches, and the other giving lengths of sixteen to twenty-six inches, the limit of width being the same as in the first. Either the ordinary knife-jointer is furnished, or an excellent form of saw-jointer, which it is claimed increases the yield for a given quantity of timber about ten per cent., requiring, however, an extra man for each machine.

The makers claim a capacity of ten to twelve thousand eighteen-inch shingles per. day of ten hours, or twenty-five to thirty-five thousand if the shingles be jointed for the sawyer, these figures being for soft wood blocks or one-third less for hard wood.

Messrs. B. & S. Massey, of Manchester, England, make a fine exhibit of Steam Hammers, which present some peculiarities of design different from the usual steam hammer, and appear to operate with great efficiency. They are double acting and work without jar or shock, giving blows dead or elastic, and of any degree of intensity, rapidity of action or length of stroke desired, the larger hammers being controlled generally by hand, and the smaller ones arranged so as to work both self-acting and by hand. The action is therefore completely under control, and can be varied according to the kind of work to be done. Generally with self-acting hammers there is great difficulty in obtaining the heavy "dead" blow so often required; but in these, by means of a hand-lever connected directly with the valve, the hammer may be changed instantly from self-acting to hand-working, and perfectly "dead" blows delivered at any time without the least delay. Their small hammers are particularly intended for smiths' work, being applicable to the lightest kinds of forgings, such as usually done by hand, and their use is rapidly replacing that of hand-work, resulting in great economy of labor, fuel and material even in the smallest smith-shops. The hammer shown by Fig. 1 is of a class comprising several sizes, and exceedingly convenient and easy to operate with, allowing ready access on three sides, and owing to the double standards on the fourth side, with opening between them, permitting long bars to be worked on the anvil in either direction. The arrangement for working the valves in these hammers, as already stated, is a combination of self-acting and hand-worked gearing, and it is different from that ordinarily employed, being without the usual cams, or sliding-wedge. As the hammer rises and falls when in action, a hardened roller on the back of the head slides on the face of a curved lever, which rotates about a pin near its upper end, and is held by a spiral spring

always in position against the roller. At every movement of the hammer this lever operates a valve-spindle and regulating-valve,

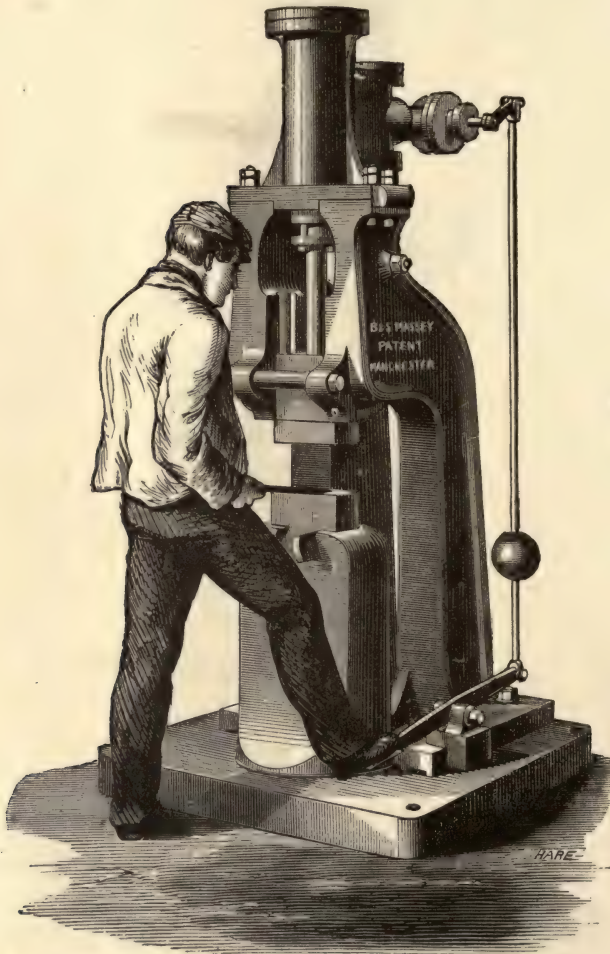


DOUBLE-ACTING STEAM HAMMER.

By B. & S. Massey, Manchester, England.

the length traveled by the hammer being controlled by another lever attached to the fulcrum-pin of the curved lever, and by which this pin may be raised or lowered, and the points at which

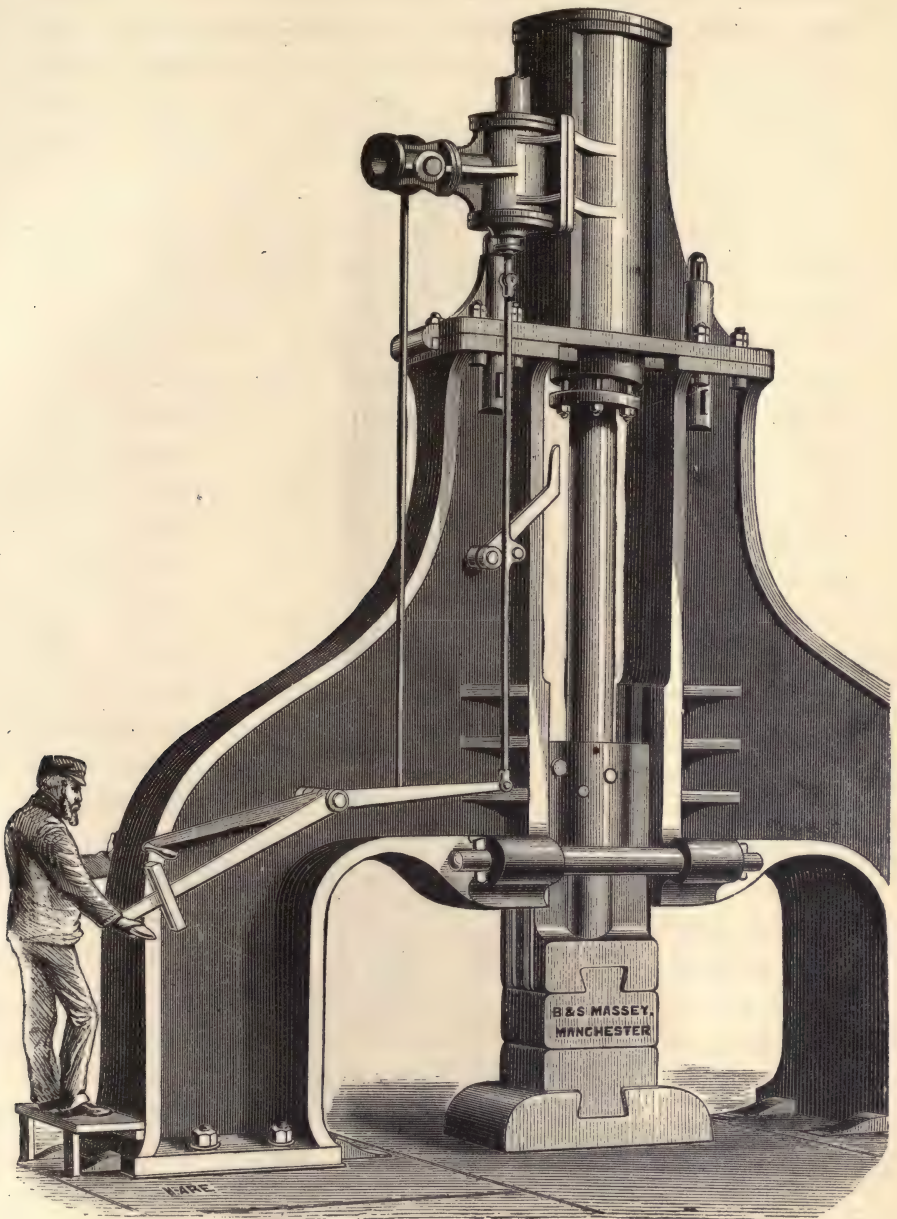
the steam is admitted or allowed to escape varied at pleasure. A guard plate and catch permit this governing lever to be fixed at any point desired. The regulating-valve is hollow through the



STEAM HAMMER, WITH TREADLE.

By B. & S. Mmssey, Manchester, England.

centre, being really a double piston opened at both ends, with a number of ports for the steam to enter and escape, arranged all around on the sides, and holding it in perfect equilibrium. The ports open and close very quickly, and allow great rapidity and



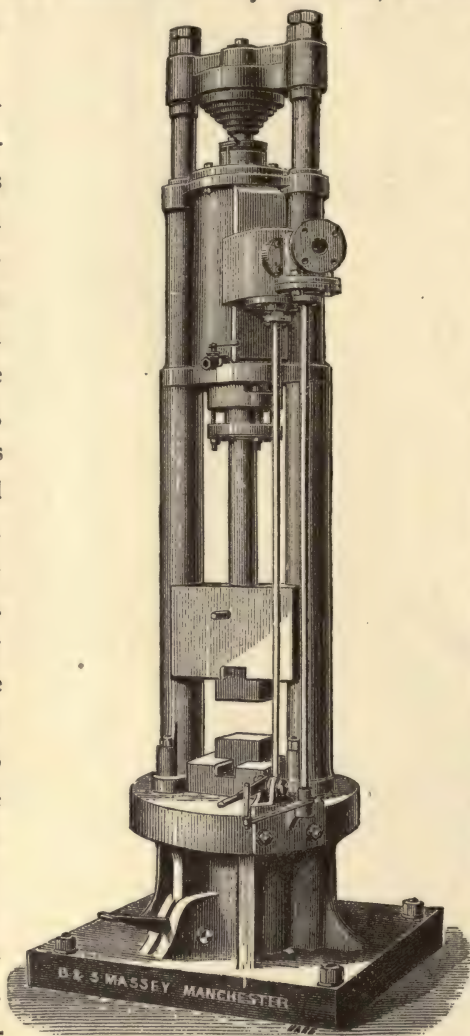
LARGE-SIZE STEAM HAMMER.

By B. & S. Massey, Manchester, England.

force of action to the hammer, as many as two hundred and fifty

blows per minute being struck with a pressure of from forty to sixty pounds, with the length of the stroke entirely under command from a few inches to nearly two feet, and variable without checking the machine.

Ramsbottom's Steel-Packing Rings are used on the hammer-piston, which is forged in one solid piece with the rod, and the head is of hammered scrap-iron. The anvil-block is a heavy casting made separate from the base and turned to fit a bored hole in the base plate so as to assure its being kept to its true position. Fig. 2 represents a light hammer, only



STEAM STAMP.

By B. & S. Massey, Manchester, England.

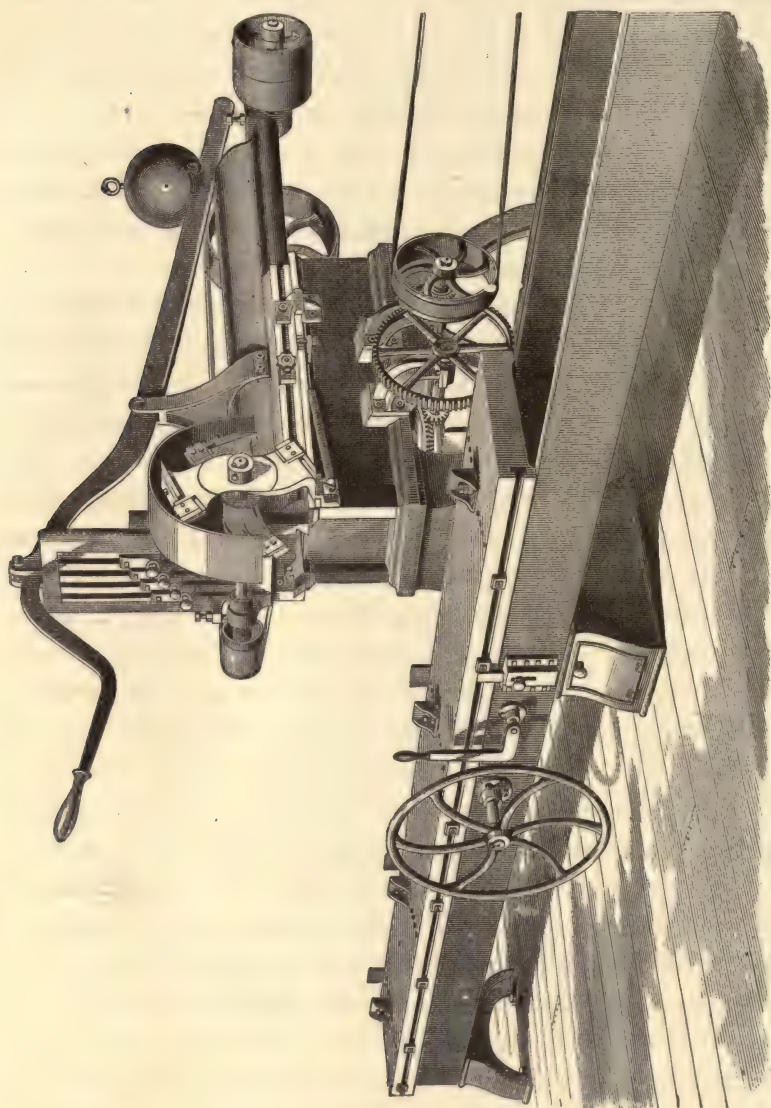
a half a hundredweight, intended for forging files, bolts, cutlery, etc., and operating with a foot-treadle, so that the workman may have both hands free for the proper manipulation of his work. The foot-treadle is omitted in some cases. This hammer has been worked up to a speed of four hundred blows per minute. Fig. 3 illustrates one of the large size hammers running up to a

ton or more in weight. Fig. 4 represents a steam stamp intended especially for die-forging, and regulated either by the foot or hand. When steam is turned on, the hammer rises to the top of stroke

and keeps that position until directed downwards by the action of the operator. It then descends with a single dead blow, performing its work, and rises again into its original position, which it retains until the workman is ready for another stroke. It is wonderful how many articles formerly so expensive are now made by die-forging, being stamped out from the red-hot iron nearly ready for use, requiring in most cases very little work to fit them up, and resulting in great saving of labor. Bolts, rivets, nuts, screw-keys, wrenches and other tools, and even such articles as sewing-machine shuttles, are made in this way.

In the manufacture of cars and in heavy railroad timber-work generally, the joining of the frames, instead of being accomplished by means of a mortise and tenon, as in ordinary building, is done by letting the ends of the cross-timbers into the longitudinal ones, thus giving much greater strength at the point of junction. The depression or groove in which the end of the cross-timber rests is technically called a gain, and a machine that is used for the purpose of cutting these grooves is called a Gaining Machine. Messrs. C. B. Rogers & Co., of Norwich, Connecticut, exhibit a timber Gaining Machine of their own manufacture, which has attracted considerable attention and does them great credit. The engraving on page 480 gives a fair view of the machine, which, being intended for the heaviest kind of work, has been made strong, heavy and substantial in every part, its weight being five thousand pounds. It is furnished with a table, to which the timber to be operated on is clamped, this table moving on ways and having adjustable stops to indicate the points at which gains are to be made. A revolving cutter-head is attached to a frame joined by sliding-gibs to a standard placed at right angles to the table, and an arrangement of gearing and belting is provided for the necessary rotary motion. The cutter-head is made in two sections, which are adjustable longitudinally on its shaft to any width of gain required, the desired depth being regulated by means of a balanced lever set at the proper elevation by adjustable stops. The head and frame at the will of the operator are made to move transversely

across the table, reversing automatically and stopping after return. In operation, the timber being clamped to the table, the cutter-



[Machinery Hall.

GAINING MACHINE.

By Messrs. C. D. Rogers & Co., Norwich, Connecticut.

“The Great Exhibition, 1876.”]

head is set by the lever at the proper elevation indicated by the stops; a lever in front throws the feed in gear, and the head moves across the timber, cutting the gain and returning to its first

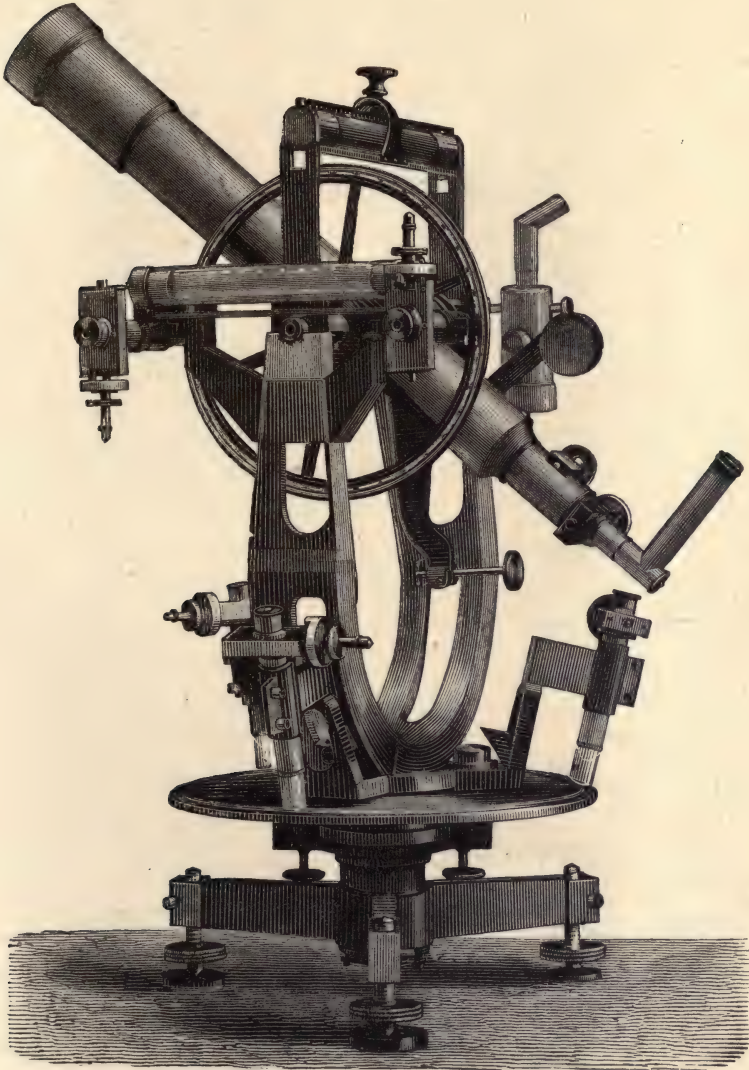
position, where it stops automatically. The table is then moved on its ways to the point marked for the next gain, and the operation is repeated. The machine is readily controlled by the operator, and after being once adjusted for any particular class of work it becomes almost automatic in its action. The points of excellence claimed for this machine by the makers are, its extreme simplicity, combined with every requisite for accomplishing its desired purpose; the great ease with which every motion is controlled, even when operating on the heaviest class of work, and the automatic precision with which this work is performed. Its peculiar feature is the reciprocating motion given to the revolving cutter-head.

We have mentioned before the fine exhibit of astronomical instruments made by Messrs. Fauth & Co., of Washington, D. C., and we refer to this exhibit again to call attention to an exceedingly perfect Altitude and Azimuth Instrument which has been purchased by the United States Coast Survey Department for triangulation and determination of azimuth. The altitude of a star or other body is its height above the horizon expressed in degrees, the greatest altitude of course being ninety degrees. The azimuth is the angle made by the meridian and the vertical circle in which a heavenly body is situated, and is measured along the horizon for the north or south towards the west, according as the north or south pole is elevated above the horizon, to the point where a circle passing through the zenith and the body cuts the horizon. The instrument of which we speak, and which is represented by the engraving on page 483, from the nature of its construction is employed in the measurement of vertical and horizontal angles, and may be used as transit for time observation, also for double zenith distances for latitude, and will determine the astronomical position of any station. For geodetic purposes it is used in primary triangulation to measure the angles with the utmost precision. It has two graduated circles and a telescope, the planes of the circles being at right angles to each other, one called the azimuth circle being connected with a solid support, on which it is leveled and kept in a horizontal position, and the other called

the altitude circle, which is mounted on a horizontal axis, which also carries the telescope like a transit. The design and construction of the instrument are quite novel, combining all the advantages of a repeating instrument without its defects. The horizontal limit, which is thirteen inches in diameter, is graduated to five minutes, and may be read off by means of three microscopes at different points to the nearest single second, these microscopes being illuminated by prisms which derive their light from overhead, and are effective for any position of the circle. This circle may be shifted if desired, so as to bring different parts of the graduation under the microscopes, and thereby eliminate any error or eccentricity in division. The vertical circle is ten inches in diameter, and is graduated the same as the horizontal circle, but is read by two microscopes, a very sensitive level reading to single seconds of arc being affixed to the microscopes to note any deviation from the vertical. This circle may also be shifted for position. Both circles are entirely free from clamps, these being attached to the centre, thereby avoiding the great risk of strain. The clamps and slow motion have differential screws. For time observation a striding level of the utmost perfection is supplied, which is set over the hard pivots of the telescope axis, so as to note any deviation from the meridian, the level being ground to a radius of about two thousand feet, each division of its graduation representing a second of arc. Both this and the level over the microscopes of the vertical circle have air-chambers to correct the bubbles for changes of temperature.

The Telescope has a focal length of twenty-four inches and a clear aperture of two and a half inches, its glass being of uncommon excellence, as is proved by the fact of its showing the companion star of Polaris. The microscope on the eye-piece measures to the one-hundred thousandth part of an inch, and is used for determining differences of zenith distances of stars in computing latitudes. For convenience in observing near the zenith, a rectangular eye-piece is provided. A lamp is placed opposite the microscopes of the vertical circle to throw light through the axis

down to the field and render the cross lines visible. This instrument is well entitled to the award which it has received, not only for

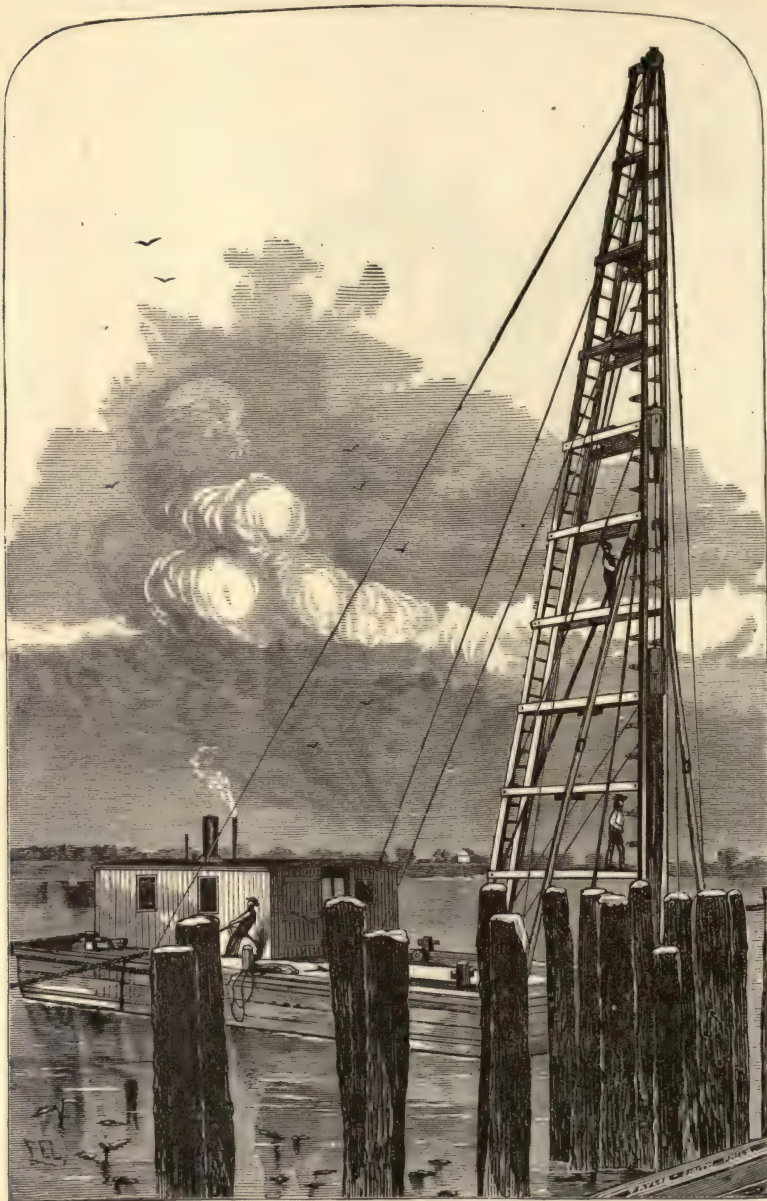


ALTITUDE AND AZIMUTH INSTRUMENT.

By Messrs. Fauth & Co., Washington, D. C.

novelty of design, but for execution and workmanship, fully confirming the encomiums which have been passed on it by so many astronomers.

One of the most novel inventions that American ingenuity has



GUNPOWDER PILE-DRIVER

By Thomas Shaw, Philadelphia.

brought into practical use during the past few years is the Gun-

powder Pile-driver of Mr. Thomas Shaw, of Philadelphia, and well worthy of its place in the great Exhibition. The originality consists in the adaptation of a material as a motive power, ordinarily so violent and destructive in its action as to be generally considered almost uncontrollable. Yet machines for driving piles by the use of gunpowder have been constructed under Mr. Shaw's patent, and have been in practical use in various parts of the country for several years with the greatest success, demonstrating high economy and efficiency.

The Machine is constructed of a strong frame-work of upright timbers with inclined braces, formed into a ladder in the rear, the whole stiffened by horizontal struts and diagonal ties between. On the inner opposing faces of the uprights, guides are formed, in which a steel or iron gun and a ram move vertically. The gun rests on the top of the pile, being recessed on its under face for this purpose, and it is bored in its upper end to receive a plunger or piston, fitting nearly air-tight, which is fixed to and projects below the ram placed above. The upper end of the ram is also bored to receive a fixed piston, projecting below a cross-head at the top of the guides, creating an air-cushion to check the upward movement of the ram should it be subjected to the force of an excessive charge of powder. In the rear of the uprights and placed parallel to them, running their whole length, are powerful double friction-brakes, operated by a compound lever near the foot of the machine, and used to check and hold the ram at any required point of elevation.

For expeditious working it is desirable to have a double-drum hoisting-engine in connection with the machine, and when so used the operation of driving proceeds as follows: A wooden block is placed across the mouth of the gun and the ram and gun are hoisted simultaneously by one drum, which holds the gun, while the friction-break is used to hold the ram. The pile to be driven is now raised to a vertical position by the second drum, and lowered in place until its foot rests on the ground. The gun is then lowered upon the top of the pile, keeping it firmly in place; and the block of wood being

removed, a cartridge is dropped into the bore. The break is now released, allowing the plunger to fall. On entering the bore it starts the pile downward, as in the ordinary pile-driver, and an explosion of the cartridge immediately following, the motion of the pile is vastly increased, the ram being at the same time projected upward, to be arrested by the application of the friction-brake. A second cartridge is now introduced, and the ram released as before, resulting in another explosion, which drives the pile still further, projecting the ram again upward. This operation may be repeated with great rapidity as often as necessary to force the pile to the proper depth. The plunger by its sudden descent into the gun compresses the confined air into a narrow stratum or cushion, preventing actual contact of the metal and at the same time generating heat, which fires the cartridge, the force of the powder being assisted by the expansive power of the air under the additional heat, and the principles of the hot-air engine called into action. The combination of all the forces developed creates an immense power, which pushes the pile down at the same time that it overcomes the momentum of the ram and projects it back to its original position.

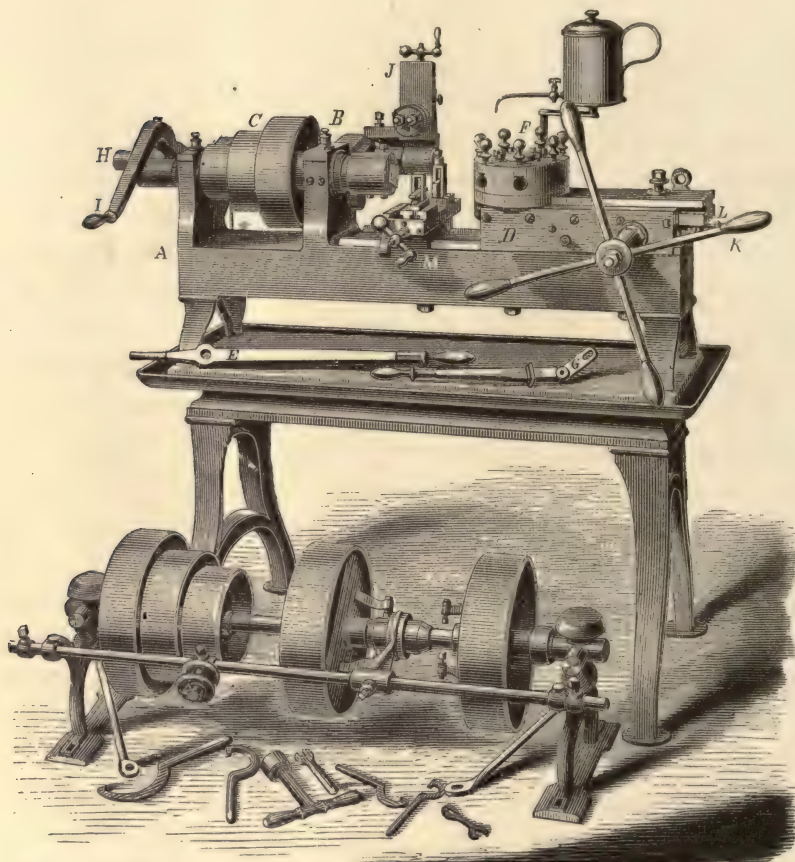
With this machine, by successive explosions of cartridges, each composed of an ounce to an ounce and a half of common blasting-powder, a pile of forty feet in length and fourteen inches in diameter may be forced its entire length into firm ground in one minute of time without the slightest injury to the timber, and entirely obviating the necessity of banding the head before driving. There appears to be no blow or concussion, the cushion or stratum of air in the gun acting as an elastic medium, and the pile being, as it were, forced into the ground as if by hydraulic pressure, instead of being pounded down as by the old methods. The sound condition in which the pile is preserved gives it greater sustaining power and lessens liability to decay. A large number of piles have been driven by this machine in the most satisfactory manner at the improvement works of the United States Naval Station, League Island, Philadelphia, both in the water and on shore.

In wharf-work the superior alignment of piles driven by this method over the old plan is a great advantage, very much facilitating the work of capping and reducing the cost in labor and material. The machine possesses great simplicity of construction, controllability and readiness of manipulation, rapidity of work, and economy and efficiency of power.

The Brown & Sharpe Manufacturing Company, of Providence, Rhode Island, with the same spirit which characterized its exhibit at Vienna, makes an exceedingly interesting and instructive display, in Machinery Hall, of that high class of tools for which it has achieved so great a reputation. These tools have chiefly developed from the requirements of the Company's general manufacturing business, which is conducted on an extensive scale, and they may therefore be said to represent the results of actual experience. In their construction, the uses for which each machine is intended have been well kept in view and every effort made to perfectly satisfy all requirements. As evidence of the character of work which these machines will execute we may mention that the firm has in its regular business manufactured over two hundred thousand Wilcox & Gibb's Sewing Machines, which uniformly attest its excellence.

Our first illustration, Fig. 1, on page 488, represents the Company's Universal Grinding Machine, an exceedingly useful tool for performing a great variety of operations in grinding by the use of solid emery- or corundum-wheels, being especially adapted for the grinding of soft or hardened spindles, arbors, cutters—either straight or angular—reamers, and standards; also, for grinding out straight and taper holes, standard rings, hardened boxes, jewelers' rolls, etc. By means of an additional movable table, adjustable by a tangent screw and graduated arc, straight and curved taper-grinding may be performed with the centres of the machine always in line. The work may be revolved upon dead centres or otherwise, and the grinding-wheel may be moved over the work at any angle, producing any taper required. Graduated arcs are provided for grinding of taper holes and angular cutters. Wheels may be used from one-fourth inch

to twelve inches in diameter, and the feed works and slides of the machine are thoroughly protected from the entrance of grit or dust. A special chuck is provided to hold work in which holes are required to be ground. The spindle and boxes of the machine



"The Great Exhibition, 1876."

UNIVERSAL GRINDING MACHINE.

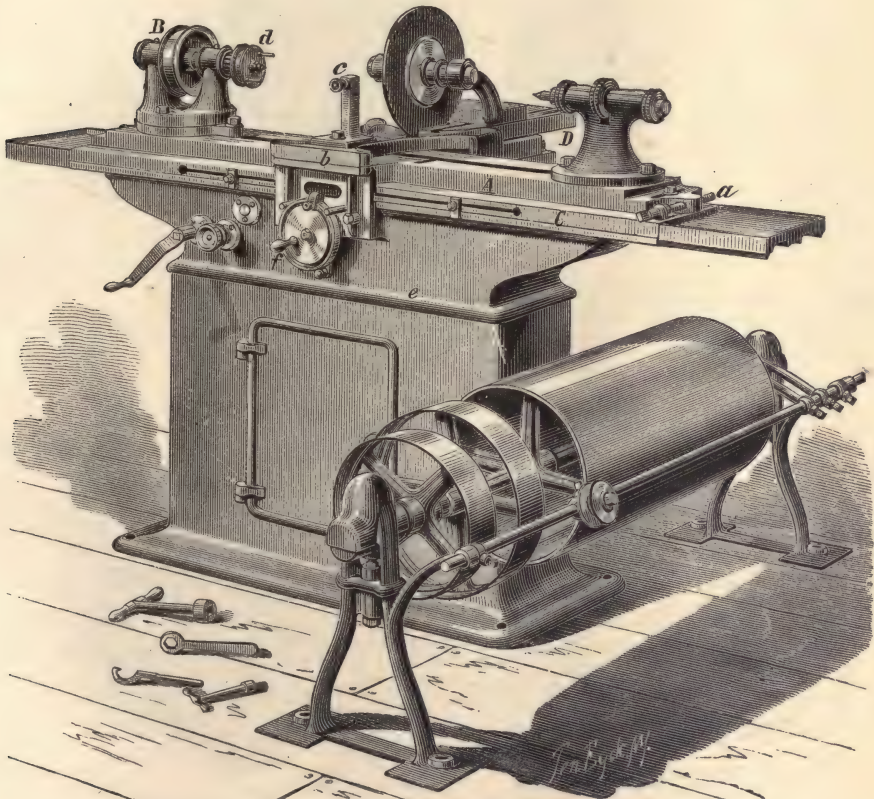
[Machinery Hall.

By Brown & Sharpe Manufacturing Co.

are of cast steel hardened and ground. Our engraving shows also the overhead works, consisting of a drum, tight and loose pulleys, one iron pulley for driving the work and grinding-wheel, and adjustable hangers with self-oiling boxes. The weight of the whole, including the overhead works, is about two thousand

pounds. This machine was purchased by a prominent firm in Alsace.

Fig. 2, shows the No. 1 Screw Machine made by this firm, together with the overhead works, the whole weighing about fourteen hundred and fifty pounds. By this machine may be manu-



"The Great Exhibition, 1876."

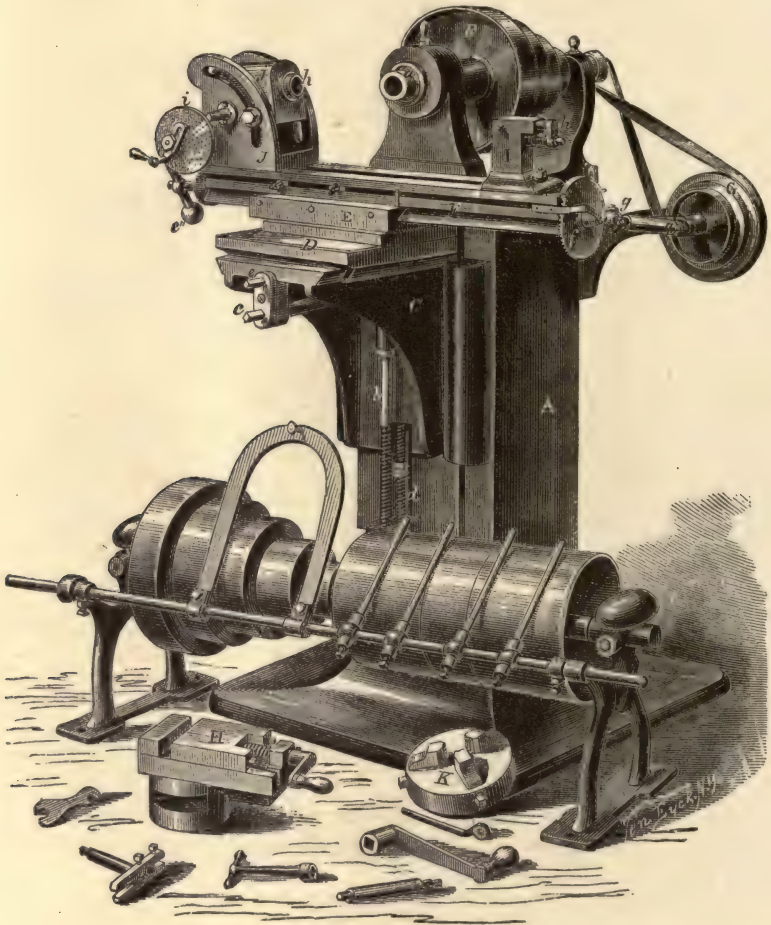
SCREW MACHINE.

By Brown & Sharpe Manufacturing Co.

[Machinery Hall.]

factured all kinds of screws and studs such as usually required in a machine-shop, and nuts, may be drilled, tapped and one side faced up; also many parts of sewing-machines, cotton machinery, gas- and steam-fittings may be made at great reduction in time and labor. It is claimed by the makers that as many screws can be made by one man with this machine as by three to

five men on as many engine-lathes, and with more uniformity in size. The size of hole through spindle is one and a quarter inches, and that in revolving head one and one-sixteenth inches,



UNIVERSAL MILLING MACHINE.

By the Brown & Sharpe Manufacturing Co., Providence, R. I.

the length that can be milled being six inches. Smaller sizes of the Screw Machines are also made; one size, No. 3, being for the manufacture of screws used in sewing-machines, fire-arms, etc.; and another, No. 4, for still smaller work, such as screws for clock-makers, etc. The last machine has a patented device for opening

and closing the jaws of the chuck which holds the wire from which the screws are made, allowing the operation to be performed in an instant without stopping, and effecting great saving of time when making small screws. It is often desirable, in threading



FOLDING AND GUMMING ENVELOPE MACHINE.

M. S. Raynor & Co.

screws and in tapping, to cut the thread up to the shoulder or to a given point, or to run the tap in to a shoulder or a given distance, and positively no further. With the ordinary tools this operation is quite difficult, causing great risk of breaking the threading-tool or injuring the shoulder of the screw. By means of a patent die-holder, however, manufactured by the firm, for use

in the revolving heads of these machines, the matter can be accomplished without special skill of any risk of damage. Special tools are also furnished, if required, for making screws of any particular form or design differing from those usually made.

Fig. 3, on page 490, shows the Universal Milling Machine of this Company, a tool that was exhibited at Paris in 1867, attracting marked attention and securing a very high award; again exhibited at Vienna in 1873, winning unusual distinction, and now coming forward at our own great Exhibition.

We close this department of our work with an illustration on page 491 of a machine exhibited by Messrs. S. Raynor & Co., of New York. It is a machine for Folding and Gumming Envelopes. In this machine the envelopes are not cut out from the web; they are cut previously by steel dies, after a fashion of paper collars. The shaped envelopes are placed in packages on a bed-plate. Over this plate is a gummer, a die on a revolving shaft, the shaft working on two supports, with a vertical motion. As the shaft revolves, the die, on the upward motion of the guides, comes in contact with a roller covered with gum, and on the downward motion it comes in contact with the edge of the upper cover of the envelope, with which it corresponds in shape, and transfers the gum to the envelope.

PART IV.

HORTICULTURAL

AND

AGRICULTURAL HALLS.





HORTICULTURAL AND AGRICULTURAL HALLS.



ENTRANCE, HORTICULTURAL HALL.

SO much has been written in class journals on the subjects of Horticulture and Agriculture that these departments will be disposed of in the briefest manner possible. The readers to whom these branches of industry are most interesting have already familiarized themselves, by the reports of magazines and newspaper corres-

pondents, with the general and special exhibits made during the course of the Exhibition. The exhibit in Horticultural Hall was

a disappointment to all—the most attractive portion of it being the exhibition of English Rhododendrons, which was held in a marquée close to the Hall in the month of July.

Horticultural Hall is certainly the finest building in the grounds, and Philadelphia may congratulate herself that this building will remain after the Exhibition is over. The building was erected by an appropriation made by the city of Philadelphia, at a cost of less than \$200,000: all this amount was not required, and by an



FORCING
Horticultural

Act of Councils the surplus was transferred to the credit of Machinery Hall, for which \$800,000 was appropriated by the city of Philadelphia, as this had cost more than the appropriation. The Horticultural Hall is located on Lansdowne Terrace, a short distance north



HOUSES.
Hall

of the Main Building and Art Gallery, and has a commanding view of the Schuylkill River and the northwestern portion of the city. The design is in the Mauresque style of architecture of the twelfth century, the principal materials externally being iron and glass. The length of the building is 383 feet; width, 193 feet, and height to the top of the lantern, 72 feet.

The main floor is occupied by the central conservatory, 230 by 80 feet, and 55 feet high, surmounted by a lantern 170 feet long,

20 feet wide, and 14 feet high. Running entirely around this conservatory, at a height of 20 feet from the floor, is a gallery 5 feet wide. On the north and south sides of this principal room are four forcing houses for the propagation of young plants, each of them 100 by 30 feet, covered with curved roofs of iron and glass. Dividing the two forcing houses in each of these sides is a vestibule 30 feet square. At the centre of the east and west ends are similar vestibules, on either side of which are the restaurants, reception room, offices etc. From the vestibules ornamental stairways lead to the internal galleries of the conservatory, as well as to the four external galleries, each 100 feet long and 10 feet wide, which surmounts the roofs of the forcing houses. The external galleries are connected with a grand promenade, formed by the roofs of the rooms on the ground floor, which has a superficial area of 1,800 square yards.

The east and west entrances are approached by flights of blue-marble steps from terraces 80 by 20 feet, in the centre of each of which stands an open kiosque 20 feet in diameter. The angles of the main conservatory are adorned with eight ornamental fountains. The corridors which connect the conservatory with the surrounding rooms open fine vistas in every direction.

In the basement, which is of fire-proof construction, are the kitchen, store-rooms, coal-houses, ash-pits, heating arrangements etc.

The illustration on page 495 shows the entrance of either east or west, both being alike; the engravings on page 496 are sketches from the forcing houses. On page 498 we engrave an interior view of Horticultural Hall, prominently in the foreground of which is the fountain by Miss Margaret S. Foley, who was selected by the Commissioners for this high compliment. Miss Foley has gained a wide-spread reputation for busts in marble, and for many beautiful conceptions in relief, a method of execution which is much admired when it comes from her hands. It is said that the fountain was originally intended for Chicago, but the great conflagration in that city caused the subscribers to withdraw, having first obtained Miss Foley's cordial consent to the withdrawal. It was then in

plaster, but when the International Exhibition was projected, she decided to carry out the idea in marble, and send it to the Exhibition as the best she had to offer to the land of her nativity. The fountain represents a vase bound with acanthus-leaves and rising from a rocky base. On the base three lovely children, who



INTERIOR, HORTICULTURAL HALL.

have just discovered this beautiful bathing-place, are preparing to bathe. One, in the exuberance of his spirits, has seized a conch-shell horn, and is blowing it lustily to call his friends to enjoy and participate in the sport. The other two, a boy and girl, are evidently having their first experience, and the eagerness and

confidence of the boy, and the shrinking timidity of the little girl



HORTICULTURAL HALL

whom he is encouraging to take her first plunge, are well expressed.

The fountain has received the approval of art-critics both at home and abroad.



"The Great Exhibition, 1876."

APOLLO.
By Mott Iron Co.

[Horticultural Hall.

Many beautiful examples of the adaptability of iron for interior and exterior ornament, were exhibited by the Mott Iron Company,

of New York—each niche in the interior possessed replicas of classic sculpture, of which we engrave a single specimen on page 500. We also engrave on pages 502, 504, 505, 507 and 509 a jardiniere, a garden-chair, seat, table, and table-top, and flower-stand, which are most creditable to this eminent firm, whose articles of artistic manufacture were to be found in the Main Building, and scattered throughout the grounds. We also engrave on page 499 a view of Horticultural Hall, as seen from the bridge across the ravine.

Agricultural Hall stands north of the Horticultural Building, from which it is separated by a romantic ravine crossed by a bridge. It consists of a nave eight hundred and twenty feet long, crossed at right angles by three transepts, each five hundred and forty feet long. The framework of nave and transepts is a succession of slight and extremely pointed Gothic arches of wood. The interior resembles that of an immense Gothic cathedral, but the effect has been injured by a multitude of slight and ineffective columns. The illustrations which we engrave on pages 512 and 513 will be readily recognized by those who have visited Agricultural Hall.

If we are to judge of the agricultural importance of a country by the area appropriated to it in the inclosure of the Exhibition park, we should be not mistaken.

The United States of America have a territory as large as the European continent. Eleven-twentieths of the whole area occupied as farms are cultivated. (Statistics of 1870.) The farms represent a value of \$10,000,000,000. The agricultural implements are estimated at a value of \$337,000,000, the value of the live-stock rises to the enormous amount of \$1,525,000,000, and this, with the agricultural production, amounts to more than \$2,000,000,000 per annum.

This country, which at the beginning of this century contained only 5,000,000 inhabitants, has to-day more than 40,000,000.

The United States, which exhibit to the world the example of a development unparalleled in the history of society, occupied the

greater portion of the space in the International Exhibition. The area covered by their exhibits of every kind was more than that occupied by all the other Commissioners. The people of the United States are

essentially practical; they are never satisfied with words or useless demonstrations; small gratifications of self love count little with them; show



"The Great Exhibition, 1876."

GARDEN-TABLE AND TOP.

By Mott Iron Co.

[Horticultural Hall]

does not affect them. A thing is of importance to them only when it

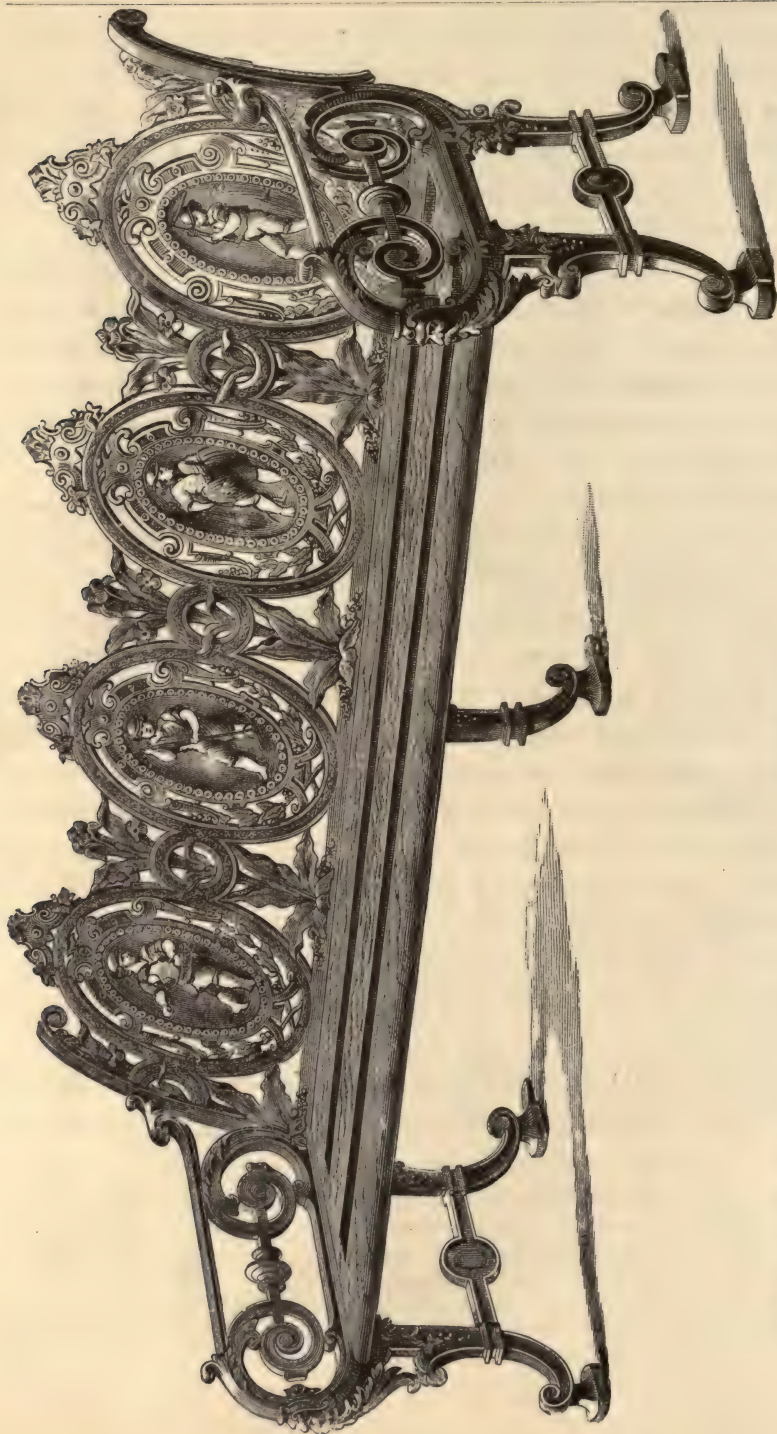
will be likely to be of immediate or early use to them, and to bring in some return. Hence, their Exhibition contrasted singularly with those of many other countries, which incumbered their galleries with collections of curious objects in nature and art, with relics or treasures more or less rare or valuable,—objects which simply excite the admiration of visitors.

All that was to be seen in the Exhibition had, on the contrary, a clearly-defined object; nothing was found there which did not yield a return. There were exhibited machines and raw materials which are extensively used in trade, or which are susceptible of becoming important for exportation. There might be found all that could strike the imagination of visitors favorably, and by creating the desire to settle in the midst of a region which produces them in such marvelous abundance, maintain or increase that formidable current of emigrants which carries away regularly each year, from old Europe, a portion of its youth and of its living forces.*

Such being the case, these magnificent bales of cotton piled like a trophy at the end of the Gallery; this splendid shrubbery covered with silken capsules, as if snow-flakes were condensed there; this rich collection of tobacco from Kentucky; the exhibition of agricultural products, fruits and vegetables, made by the Western States, which has so much land to sell and to colonize; the exhibitions by the governments of the States, the towns, and the rural villages, which by showing the immense resources consecrated by the country to the education of children and adults—all these offer new inducements and encouragements to emigration.

Samples of salts, of ores, of marble, of coal, of schist, of petroleum, photographs showing the richness of the country in mines, and

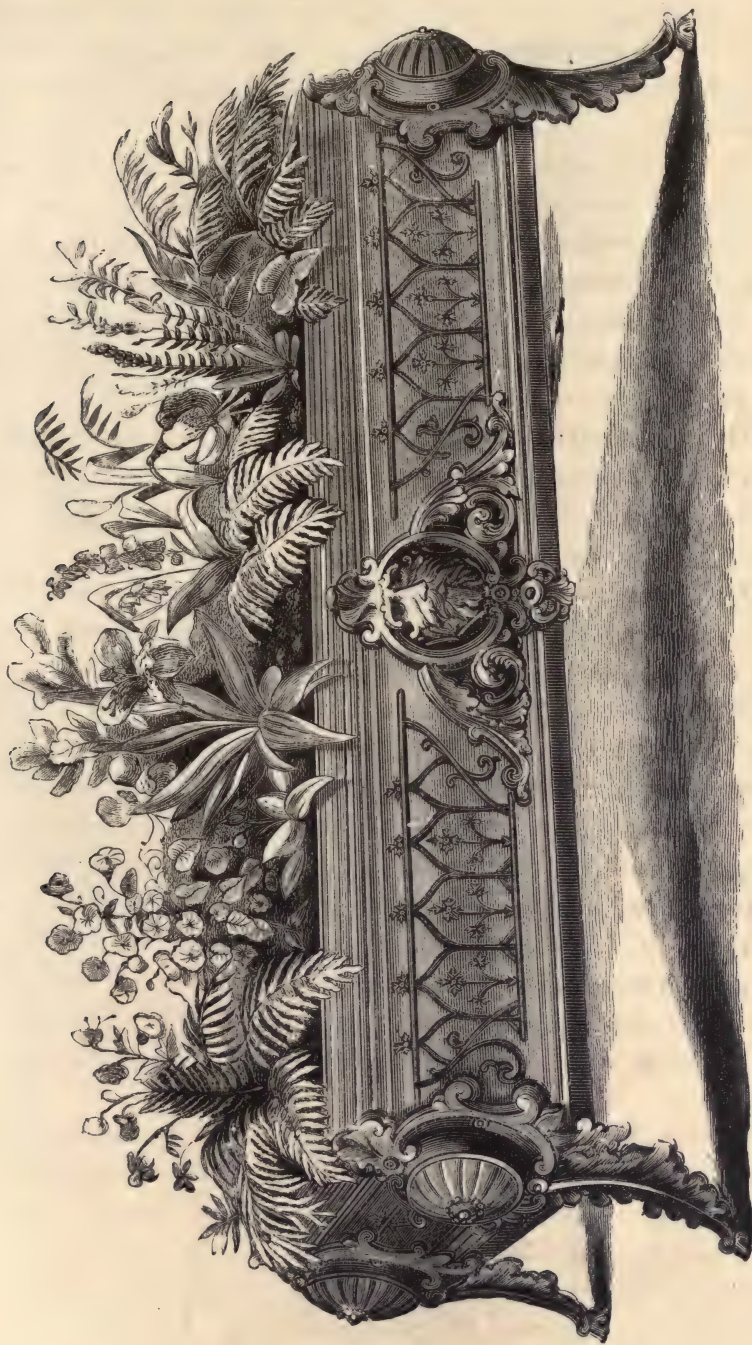
*From 1820 to 1870 the total number of emigrants who came to the United States was 7,500,000, representing a value of \$8,400,000,000 of that capital most precious to a state, that is human capital. The number of emigrants from France was 255,000, from the British Isles 3,857,000, and from Germany 2,367,000. At every revolution, or great unexpected crisis in Europe, there is a corresponding increase in emigration to the United States. Thus the events of 1870 were favorable to the United States. The European emigration was in 1871, 1,000 persons per day. In 1872 this number had increased to 449,030 individuals, but since 1873 the tide of emigration has fallen off to a wonderful extent.



(Horticultural Hall.)

GARDEN SEAT.
By Matt Iron Co.

—The Great Exhibition, 1876.—



[Horticultural Hall.]

JARDINIERE.
By Mott Iron Co.

[The Great Exhibition, 1876.]

even the picturesqueness and splendor of nature in the mountains—nothing is wanting to allure visitors and entice them toward these countries as toward an unexampled Eldorado; so much for colonization.

In the hall which protects the products we found a large collection of reapers and mowers; that is the instruments that the Americans manufacture on a vast scale, and which are the object of a large commerce to them. Of drills, plows and hoes we saw equally large numbers there; the manufacturers knowing well that they are now in a condition to compete for these articles with the European manufacturers.

They exhibited also quantities of machines for cutting grass, and beautiful collections of steel tools, such as shovels, forks, scythes, and rakes of remarkable lightness and durability; these are always articles of exportation.

The principal products exhibited by the United States were cereals from one part and from the other cotton, tobacco, hemp and a certain quantity of products of animal origin. Among the cereals exhibited we ought to mention particularly the beautiful specimens sent from California. The grains almost all belonged to the varieties of tender wheat and of light color; the red grains were in the minority. A white variety of winter-wheat was especially remarkable. They took care to put with them beautiful sheaves showing the quality and great size of the straw of each variety. We saw here sheaves of wheat of the height of seven feet, sheaves of white oats from seven to eight feet, bundles of clover and timothy fifty inches in height. The barleys exposed were also very beautiful and belonged to the chevalier variety.

A magnificent collection of maize in the ear and in the grain; specimens of broom as beautiful as those which are cultivated in Algeria and in Spain; specimens of fruits and vegetables of all sorts completed this interesting collection.

Oregon also exhibited beautiful cereals, among which should be mentioned the winter-wheat called mammoth white wheat, which



"The Great Exhibition, 1876."

GARDEN-CHAIR.
By Mott Iron Co.

[Horticultural Hall.]

is very delicate and tender and furnishes a choice flour, the mammoth spring-wheat, with grain larger and smaller, the golden amber, winter variety, grain larger on the average, of a pale color, white and translucent; the winter-wheat, yellow and large grained.

We should describe also among other cereals exhibited by the United States, a variety of white spring-wheat, small ovoid grains pointed at their two extremities, hard to the teeth and known by the name of white club wheat. This wheat comes from the country of the Mormons, which has been cultivated for ten years; it is at a little distance from Salt Lake, Utah; it exhibits qualities which make it preferable in those remote regions to all other varieties. It has the quality, they assure us, of resisting the greatest drought. It grows well even in those regions where it hardly ever rains. Though some exaggeration cannot be avoided in these statements, this wheat does not the less merit our attention. It seems desirable that the experiment should be made in those parts of the country most subject to great drought, and on the plains especially. Should this variety realize but the half of the advantages attributed to it, its propagation would still be important in the West.

The Rocky Mountain spring-wheat has similar qualities and characteristics. It is recommended for stony soils. It is also a small-grained wheat, very hard and very heavy. The exhibition of corn, as in the exhibition at Vienna, presented a great many different varieties. It is the plant *par excellence* for American culture. This is also the grain of all others which gives the largest return to the United States in the actual conditions of culture. The varieties of corn cultivated in the United States are also increasing very rapidly. There could be seen on the shelves of the American exhibitors ears of all sizes and of all colors, having grains of all shapes and all sizes, from the pearly maize to the great maize of Illinois and Nicaragua.

The numerous specimens of tobacco exhibited show the importance which we attach to this culture. It is said that this plant, by furnishing capital to the first colonies established on the Alleghany slopes, was to the United States the first, and one of



"The Great Exhibition, 1876."

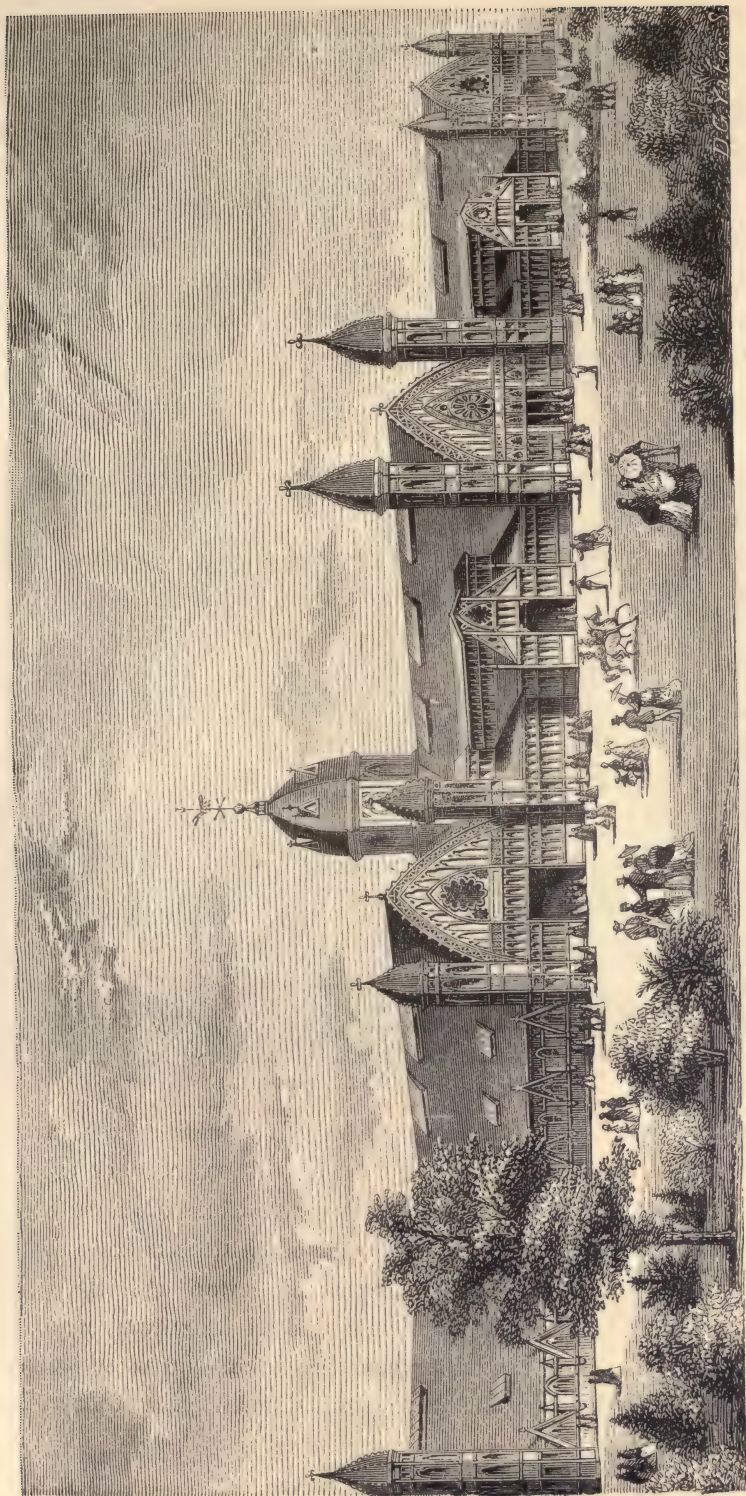
GARDEN FLOWER-STAND.

By Mott Iron Co.

[Horticultural Hall.]

the most powerful means of development. Virginia, Ohio, Louisiana, Missouri and Kentucky exhibited some very beautiful leaves from the harvest of 1874 and 1875. When one thinks of the immense resources which the United States received in the beginning in the profits of this culture we see that the example should neither be forgotten nor lost; the result is worth some consideration, some sacrifices, especially in the beginning. We should never forget that money gained by agricultural labor is worth more than money given or expended in premiums or in building houses. It is worth more than gold found in the ground, as the history of Spanish America proves.

We disregard what we owe to the culture of tobacco; but it is to cotton—to king cotton—that we render honor; so its place was a marked one in the Exhibition. At the head of the galleries occupied by American products might be seen a cotton-plant covered with hundreds of full-blown seed-pods. It was there the emblem of the wealth and power which it gives to the country; behind, they set up like a trophy a pile of cotton-bales from Louisiana and Georgia. The long-staple cotton of this latter country at once attracts attention by its fineness, its elasticity, and the silky look of its fibers. Of all the states, Louisiana made the most beautiful exhibition of this product. An exhibitor from New Orleans presented an interesting collection of cotton-plants grown in different soils, and from different seed, with capsules closed and open, showing the condition of the textile material in all stages of its growth. Missouri and Texas also exhibited some beautiful specimens. The cotton-cultivation is always cantoned on both sides of the lower part of the Mississippi and on the eastern part of the portion south of the Alleghany chain, in Alabama, Georgia and the Carolinas. It does not extend beyond this. Besides these productions, there were specimens of hemp, flax, vegetable hair (moss) picked from the branches of a tree in Louisiana, with sugar-canes, specimens of guano and of powdered bone, which present no peculiarities worthy of special notice. Some bottles of wine, adorned with labels more or less imposing, attracted attention.



AGRICULTURAL HALL.

Imitations of champagne wine were especially abundant, under the names of "Sparkling Catawba" wines, "Sparkling Imperial," "Sparkling Golden Seal," "Pearl of California," and even "Matchless Sparkling." These products mostly from Ohio, California and Missouri, do not nearly equal foreign wines, but one can see in them what American perseverance will finally make a success. The United States produce to-day 1,500,000 gallons of wine. This is certainly very little in comparison with the amount consumed; and though progress is rapid, it is probable that North America



AGRICULTURAL HALL, THE MILL.

will long go to Europe for fine wines. Our importations, in spite of excessive duties, amount to upward of \$8,000,000 per annum.

The exhibition of California deserves special mention, for besides magnificent cereals, numerous specimens of wine, fruits and minerals, it included also beautiful specimens of cotton and silk. This country, by its character, its climate and all its natural resources, seems to be, of all the States of the Union, the most likely to imitate the agriculture and raise productions similar to Southern Europe.

The American implements were remarkable for beauty and finish. All were fashioned, put together, and polished like clock-work. The steel hand-implements, such as forks, scythes, shovels and spades, are well known. It has been seen in former exhibitions that they are at once light, flexible and durable. We cannot fail to mention the exhibition of Remington & Co. whose works use steam to the amount of one hundred and fifty horse-power, and manufacture a great quantity of them. The jury of this group,



AGRICULTURAL HALL, INTERIOR.

Brazilian Department.

recognized the value of the productions of this house by according to it honorable mention.

The house of Furst & Bradley, of Chicago, is considered superior in this manufacture, in the quality of the work, and in the durability of the plows; some are all of iron, with the beam bent round like the neck of a swan; others having the beam and handles of wood with the mold-board of cast-iron or steel. This house sells mostly the so-called American plow, in which the coulter is replaced by a cutting-edge.

Among other exhibitors of plows we should mention the house of Deere & Co., whose great establishment is situated at Moline, Illinois. Messrs. Collins & Co., of Hartford, whose plows of steelified iron have already been given an award at the Universal Exposition at Paris, in 1867. Their double-share plow, all of iron, made with extreme care, is a model of good workmanship and fine finish.

The farmers of the United States are accustomed to sow seed in drills. Experience has proved, in fact, that in the great plains of the Middle and of the Western States, where cereals are grown on so vast a scale, sowing in rows insures better gathering; the plants sown in drills root more firmly, and better resist cold, tempests and particularly those violent winds which injure the harvest by drying up the soil. Besides economy in sowing, this distribution always insures a large production of grain; the wheat is better nourished and is of better quality. These results are easily understood; the grains being deposited uniformly, at just the proper depth, the germination is regular; the roots develop uniformly and penetrate further into the soil. Consequently they are more sheltered from the cold, and from the scorching summer winds; the plants shoot forth more vigorously and steadily. These advantages, are well known to American planters. Thus, during these latter years, the manufacture of seeding-machines has attained considerable importance in this country.

We must now leave the subjects which are of the greatest interest and importance to the United States, but unless illustrated in the highest manner—and consequently most expensive—in colors, it is difficult to make the subjects pleasing to the eye, whilst these pages are not the place for a technical discourse. A more pleasing and more instructive chapter waits our readers in the next division of this work.

PART V.

INTERNATIONAL EXHIBITIONS

AND THE

CENTENNIAL EXHIBITION.



From Gibbie & Barrie's "Masterpieces of the U. S. International Exhibition, 1896."



INTERNATIONAL EXHIBITIONS.



THE FIRST EXHIBITION of which we have any record was that of 1798, born of the Revolution, a reaction as it were from the turbulent spirit of the times, back to the pursuits of peace and industry. The Marquis d'Avèze, shortly after his appointment in 1797 as Commissioner of the Royal Manufactories of the Gobelins, of Sevres and of the Savonnerie, found the workmen



EXHIBITION BUILDING, PARIS, 1844.

reduced nearly to starvation by the neglect of the previous two years, while the storehouses, in the meantime, had been filled with their choicest productions. The original idea occurred to him to have a display and sale of this large stock of tapestries.

china and carpets, and obtaining the consent of the government, he made arrangements for an exhibition at the then uninhabited Chateau of St. Cloud. On the day, however, appointed for the opening, he was compelled by a decree of the Directory, banishing the nobility, to quit France, and the project was a failure. The following year, however, returning to France, he organized another exhibition on a larger scale, collecting a great variety of beautiful objects of art and arranging them in the house and gardens of the Maison d'Orsay for exhibition and sale. The success was so great that the government adopted the idea, and the first official Exposition was established and held on the Champ de Mars, a Temple of Industry being erected, surrounded by sixty porticoes, and filled with the most magnificent collection of objects that France could produce. Here was first inaugurated the system of awards



EXHIBITION BUILDING, PARIS, 1849.

by juries, composed of gentlemen distinguished for their taste in the various departments of art, and prizes were awarded for excellence in design and workmanship.

The government was so satisfied with the good effects resulting from this exhibition, that it resolved to hold them annually; but notwithstanding the circular of the Minister of the Interior to this effect, the disturbed state of the country prevented a repetition until 1801. The third exhibition was in 1802, where there were six hundred prize competitors. These expositions became so popular as to result in the formation of a *Société d'Encouragement*, thus creating a powerful aid to the industrial efforts of the French manufacturers. At the fourth exhibition, in 1806, the printed cottons of Mulhausen and Logelbach, and silk-thread and cotton-lace were first displayed and prizes were adjudged for the manu-

facture of iron by means of coke, and of steel by a new process.

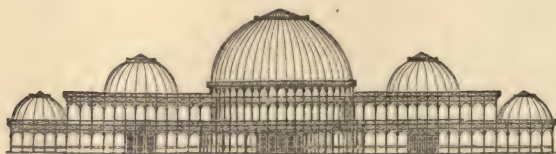


INTERNATIONAL EXHIBITION, LONDON, 1851.

Foreign wars prevented further exhibitions until 1873, after which

time they became more frequent, being held in 1823, 1827, etc.; the tenth being in 1844, the last under the reign of Louis Philippe, when three thousand nine hundred and sixty manufacturers exhibited their productions. In 1849, notwithstanding the political revolution through which France had just passed, she organized another exhibition on a still grander scale than any previous one, covering an area of 200,000 square feet, exclusive of an agricultural annex, and costing about the same price per square foot as the building of 1844. At this time the number of exhibitors had increased from one thousand four hundred, in 1806, to nearly five thousand, there being no less than three thousand seven hundred and thirty-eight prizes awarded, and the building remained open for sixty days.

Each of these previous exhibitions had been strictly national,



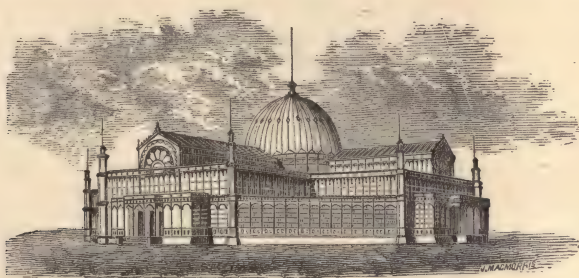
DUBLIN EXHIBITION BUILDING, 1853.

confined to the products of the special country by which it was held. The idea seems to have been suggested, however, in France, in 1849, of giving an international feature to that exhibition; M. Buffet, the Minister of Agriculture and Commerce, having addressed a circular letter on the subject to various manufacturers, with a view of ascertaining their opinions; but the resulting replies were so unfavorable that the project was abandoned, and France lost the opportunity, which was reserved to England, of the credit of the first really International Industrial Exhibition, in that of London, 1851.

After various preliminary proceedings, the Royal Commission was issued, and at the first meeting of the Commissioners, on January 11th, 1850, it was decided to rely entirely upon voluntary contributions for means to carry out the plans proposed. The appeal made to this effect was answered in a most encouraging

manner; a guarantee fund of \$1,150,000 was subscribed, one gentleman opening the list with \$250,000, and contributions began to come in from all directions.

Upon the security thus provided the Bank of England undertook to furnish the necessary advances. The contract was not finally consummated until the end of October; but with courage and enterprise the work was pushed forward in order to insure the completion of the building at the time fixed for the opening,—the first of May, 1851. It was opened at the time appointed, by the Queen in person, with great ceremony, although considerable work still remained to be done. The inauguration was one of the most imposing sights that had ever been witnessed in Great Britain. Our engraving gives a view of the building on the south side,



CRYSTAL PALACE, NEW YORK, 1853.

extending east and west, and showing the main entrance at the great transept.

The exhibition of 1851 was in every way a great success. Upwards \$200,000 had been received from the sale of season tickets alone before the opening. During the six months that it remained open, from May to October inclusive, the average daily number of visitors was 43,536; the total number for the whole time was 6,170,000, and the amount of receipts, \$2,625,535; there being a balance of \$750,000 in the hands of the Commissioners after all expenses were paid. The exhibitors, coming from all parts of the world, amounted to more than 17,000.

The success attending this exhibition stimulated other countries in efforts to have something of the same kind. Exhibitions, more

or less local in character, were projected and held in the large manufacturing towns throughout the British Empire,—at Cork, Dublin, Manchester, etc.

That at Dublin, in 1853, under the auspices of the Royal Dublin Society, which had previously had triennial exhibitions, was the result of a proposition made to the Society by Mr. William Dargan, a well-known contractor, providing a certain fund for the exhibition under certain conditions; and, although international in its features, was not practically as entirely so as the exhibition of 1851. We



STATUE OF GENERAL WASHINGTON.

By Baron Marochetti.

give an elevation of this building, which shows very clearly its general design.

This same year an International Exhibition was also held in the City of New York under the organization of a few influential citizens, as a joint stock company, clothed with sufficient powers by legislation to carry out the objects proposed. This exhibition had in view the comparison of the productions of America with those of other countries, with the object of the promotion of her advancement, it being acknowledged that she had more to gain by such comparison than any other of the great nations of the world. It was liberally assisted by contributions of exhibits from European

manufacturers and artists, but misfortune seems to have attended it from the beginning.

The opening, although advertised to be early in June, did not take place until the middle of July, in the midst of our hot season; President Pierce formally taking part in the exercises, in the presence of six commissioners of Great Britain, those of many other foreign governments, and all the heads of the various State departments.

The area covered by the first floor was 157,195 square feet, and by the galleries, 92,496 square feet, making a total floor space of 249,692 square feet, or about $5\frac{3}{4}$ acres, and the quantities of material used in the structure amounted to 300 tons of wrought



EXHIBITION, MANCHESTER, 1857.

iron, 1500 tons of cast, 55,000 square feet of glass, and 750,000 feet, board-measure, of timber.

We give an exterior view of the building, which has now passed away from sight forever, having been entirely destroyed by fire in 1858.

We also present an engraving of the Equestrian Statue of Washington by Baron Marochetti, the largest work shown at this exhibition, and located in a prominent position immediately under the dome. The artist was an Italian sculptor of note, born in Turin, in 1805, long resident in France, and who died in 1867, in London, where he had removed on the outbreak of the French Revolution, in 1848.

France, encouraged by the great success of the London exhibition of 1851,—regretting, perhaps, the opportunity which she lost

in 1849, of setting the example of the international feature in exhibitions, and conscious that the exclusive or merely national system which she had previously adopted, would if continued, be detrimental to the best interests of herself, and contrary to the national pride of her people,—determined to hold an International Exhibition in 1855, which she did with marked success.

In the year 1857, Manchester, England, held an exhibition of Fine Art and Fine Art Manufacture, more particularly confined to the Art Treasures of the United Kingdom,—plans being advertised for in May, 1856, with the conditions that the building must be fire-proof, must cover about 135,000 square feet, or a little over three acres, at a total cost of not more than \$125,000, and must be capable of erection within six months.



EXHIBITION, FLORENCE, 1861.

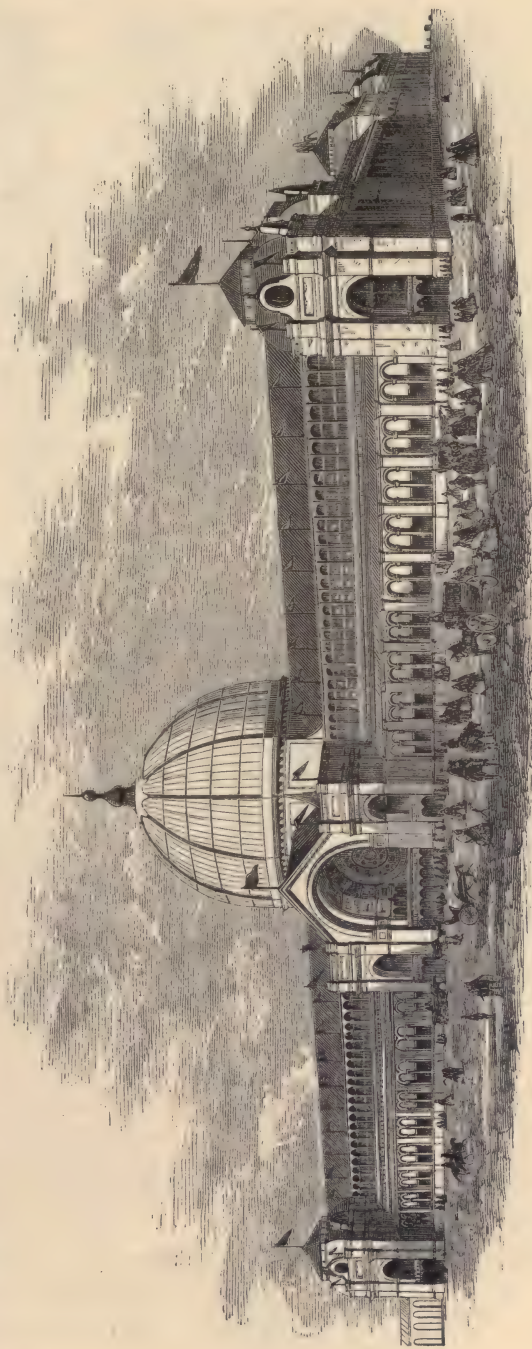
The Art Treasures included the works of the old masters—commencing with the oldest specimens that could be obtained—and were intended to show the gradual progress in Art from the earliest epoch, on through the periods of Titian, Correggio, and Rubens, up to the modern Schools of Art, especially those of England.

Italy—with its principalities freed from the trammels and tyranny of a foreign yoke, and united into one grand nation—resolved upon holding an exhibition at Florence in 1861, for the purpose, perhaps, of inaugurating its new birth, and taking its place among the kingdoms of Europe. Previous exhibitions had been held in various parts of Italy—some at a remote period—but they partook more of the nature of agricultural exhibitions. There had also

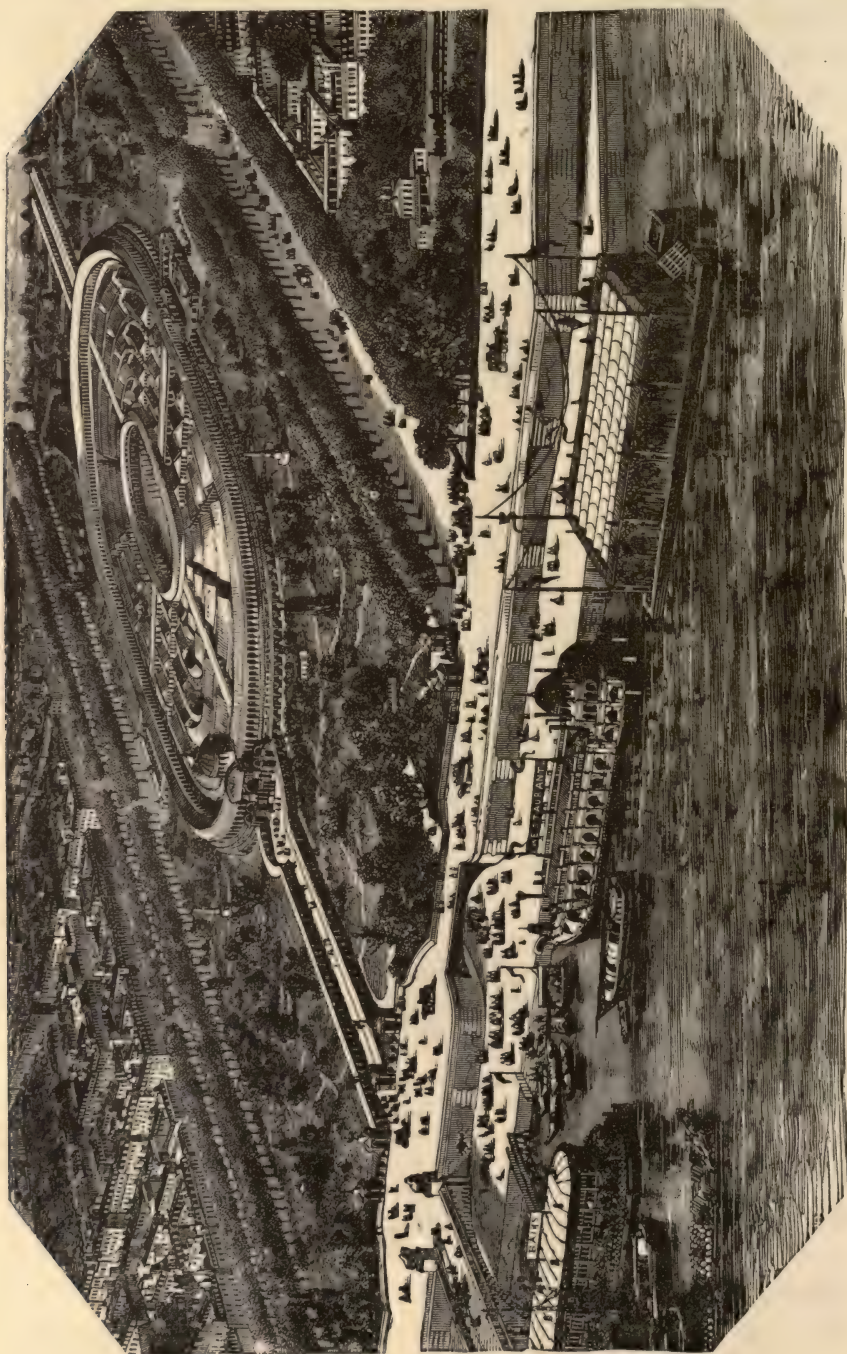
been one at Naples some years before, but this exhibition, now held, was far superior to any that preceded it, and forming, as it did, an exceedingly attractive display of Italian industrial, fine art, and agricultural products, it seems singular that it did not attract the attention from abroad that its importance deserved.

We present an exterior of the permanent portion of the main building. The display of the peculiar agricultural products of northern and central Italy was particularly rich, and the fine art collection could not have been otherwise than excellent.

On the 14th of March, 1860, a Charter of Incorporation



INTERNATIONAL EXHIBITION BUILDING, LONDON, 1862.



INTERNATIONAL EXHIBITION AND GROUNDS, PARIS, 1867.

ration was issued by the Queen to Royal Commissioners for this exhibition, defining their duties and investing them with full powers,—the Prince Consort being made President of this Commission. It was decided, in anticipation, to test the popularity of the undertaking by public subscriptions, and a Guarantee Fund of \$1,250,000 was formed with a rapidity beyond all expectation, allowing of the formal execution of the Guarantee Deed to the full amount by the 15th of March, the day after the incorporation of the Commission. This Guarantee Fund was



PORCELAIN VASE.
Exhibited at Paris, 1867.

afterwards signed by 1157 persons, in all, to the amount of \$2,255,000, and upon this security, the Bank of England advanced \$1,250,000 for the expenses of erecting the buildings and making the requisite preparations for the Exhibition.

We present an exterior view of the building from Cromwell Road, which will give the reader a very fair idea of its appearance.

The design was severely criticised at the time; the frontage showing to the right on the picture, especially being condemned as featureless and ugly; and the Art Journal characterized the building as "the wretched shed that was the Fowke version of the Paxton Crystal Palace."

The total area roofed in was 988,000 square feet—larger than that of any previous exhibition; but the total area of space covered and uncovered, and available for exhibition purposes, was not as great as that of Paris, 1855; the proportions standing 1,023,000 in the present case, to 1,500,000 in the other. The total cost was not less than \$2,150,000, equal to about \$2.18 per square foot. Including the expenses of the exhibition, during the time it was



MORNING.

open, the total amounting to \$2,298,155, and the entire amount received by the Royal Commissioners amounted to precisely the same sum, making no loss or no gain,—the exhibition just self-sustaining and no more.

Whatever may be said of the Emperor Napoleon III, all will admit that he systematically labored to advance the interests and promote the happiness of the people under him, continually engaging in projects for the development of the great natural resources

of his empire; originating and giving an impulse to national industries, before unknown, and taking every opportunity of pleasing the inherent tastes of his people, and gratifying their pride by improving and adorning Paris, until it grew to be called the most beautiful city of the modern world—the very Heaven of the pleasure-seeker. In strict accordance with his expressed views, and with the characteristic features of his reign, he decided upon holding a great International Exhibition in Paris, in 1867, and on the 22d of June, 1863, an imperial decree was issued to this effect; the “Universal Exposition,” as it was called, being intended to comprise typical examples of works of art, and of the industrial



MEDALS OF THE PARIS EXPOSITION, 1867.

products of all countries, and to include every branch of human labor or skill. The invitation was extended to artists, manufacturers and workers of all nations, to take part in the Exposition, and it was expressly stated that the decree had been issued so early in order to afford all desiring to enter the Exposition ample time for mature consideration and reflection, and for arranging and carrying out the necessary preparations. This was followed by a second decree in February, 1865, confirming the previous one, explaining in full such details as had become at that time necessary, and defining the leading features of the proposed exhibition.

The site selected for the exhibition was the “Champs de Mars”—the same spot upon which was located the first French

Exposition of 1798—a rectangle of 119 acres, to which was attached, also, the Island of Billancourt, affording an additional area of 52 acres, or 171 in all. The main building was located upon the former, and the latter was used for the Agricultural Department. An elliptical form of building was adopted, or, in reality, a rectangle with rounded ends; the length of the straight portion between the curved ends being 360 feet, the total length 1,608 feet, and the width, 1,247 feet. The total area within the outer limits of the



CARVED FRAME.

Exhibited at Vienna, 1873.

building was $37\frac{8}{10}$ acres, and an open garden of $1\frac{1}{2}$ acres occupied the centre, reducing the amount under roof to $36\frac{8}{10}$ acres.

Among the Photographic exhibits was a fine series of views of the Yosemite Valley, by E. Watkins, of San Francisco; also, Rutherford's photographs of the moon and the solar spectrum, attracting great interest from the savans, and receiving a silver medal.

Among the musical instruments, Steinway & Sons, of New, York, and Chickering & Sons, of Boston, were considered as having the

best pianos in the Exposition, and although the Jury of Awards had only four gold medals to award to this class, they each received a gold medal, and the fact of two going to America, under the circumstances, was a great honor. Mason & Hamlin's Cabinet Organs were objects of great interest on account of their superior workmanship and singularly pure tone, and received a silver medal.

Pottery stands among the earliest of art manufactures, and in none has there been less change; the finest designs of the present day being of the same forms as in use two thousand years ago.



JEWELRY.
Exhibited at Vienna, 1873.

Taking a material possessing primarily less value than almost any other used in the arts, the manufacturer, by the exercise of labor, skill and taste, produces forms ministering greatly to the necessities of man, and often of untold value, ranging from objects of every-day use to the porcelain of Sèvres. We engrave on page 527 a vase produced from the Imperial Manufactory of Sèvres, a beautiful work of art and an excellent specimen of the gems which are created in that school of pottery, so creditable to the government which has established it.

Mr. Harry Emanuel, of London, exhibited in *repoussé* silver,



ARTISTIC IRON RAILING.
Exhibited at Vienna, 1873.

Tazze of Night and Morning, designed by the eminent artist Pairpoint, of which an engraving of the latter, given on page 528, conveys an excellent idea.

There were at this exhibition over 12,000,000 of entrance tickets recorded, representing at least 4,000,000 of different visitors. The total cost of the main exhibition building was \$2,356,605. The total expenses were \$4,688,705, and the total receipts were \$5,251,361, leaving a net profit of \$562,654, of which dividends were declared of \$553,200, and the balance of \$9,456 was held for unforeseen events and finally used for the public good.

Exhibitions were held at Copenhagen and Moscow, in 1872, and one of Domestic Economy, in Paris, the same year. These exhibitions were all more or less of a local character, that at Copenhagen being confined to the products of Sweden,

Norway and Denmark. The Moscow Exhibition, which was on a

considerable scale, was held under the auspices of the Moscow Polytechnic Society, with the favor and protection of the government.

Active measures for an international exhibition to be held in Vienna in 1873, were first taken by the Trades' Union of the city. According to the original arrangements, a guarantee fund was formed of \$1,500,000, and subscriptions to this amount were obtained—chiefly among members of the Society—it being supposed that the receipts from the exhibition would nearly, if not quite, meet the expenditures, and that this fund



IRON STOVE FROM SILESIA.
Exhibited at Vienna, 1873.

possible deficiencies. The total area of ground for exhibition purposes comprised within the surrounding fence was about 280 acres.

The principal buildings for the exhibition were the Palace of Industry, or main exhibition building, for miscellaneous manufactures, the Gallery of Fine Arts, the Machinery Hall and the Agricultural Building. In addition to these were various other buildings for minor purposes, similar to those distributed around the Main Exposition Building of Paris in the Champs de Mars.

There were cross transepts, thirty-two in

number, at intervals throughout the whole length of the nave,

extending through both on the north and south sides, and having



JARDINIÈRE, GILT BRONZE.

Exhibited at Vienna, 1873.

a length from face to face of 246 feet 3 inches. The main entrance of which we give a view on page 535, was in the middle of the

south side of central-square. It was designed like a grand triumphal arch, having a central arched opening, flanked on the sides by pairs of pilasters decorated between with niches, figure-



MAIN ENTRANCE, INTERNATIONAL EXHIBITION, VIENNA, 1873.

subjects and medallions of the Emperor and Empress, and the whole crowned by a group of emblematic figures in plaster.

In making a cursory review of the articles exhibited at Vienna, we may state that the display was the most extensive that had ever previously been made in any part of the world, and the

admirable way in which the exhibition had been carried out gave to it additional interest. Some charming works in Carved Wood were shown by Mr. G. A. Rogers. The design and carving of the specimen we show on page 530 were both by Mr. Rogers.



JURY PAVILION.

In Goldsmiths' Work and Jewelry, Froment-Meurice—whose father was styled the Cellini of France—exhibited beautiful specimens of work, and we engrave on page 531 three examples of his ordinary every-day productions, which are always characterized by beauty, richness and great artistic taste.

There was a large and creditable mineral exhibit from the United States; coal, iron, lead, copper from Lake Superior, quicksilver, silver and gold from Idaho and California, and emery from Massachusetts. The ornamental cast-iron productions of Durenne, of Paris, were particularly noticeable for beauty of design and excellence of work. We reproduce on page 532 a specimen of railing exhibited by him.

We close the very few engravings of the exhibits which our limited space has allowed us by a beautiful flower-vase in gilt-bronze, executed by Hollenbach from a design by Claus, of Vienna,



CONNECTICUT STATE BUILDING.

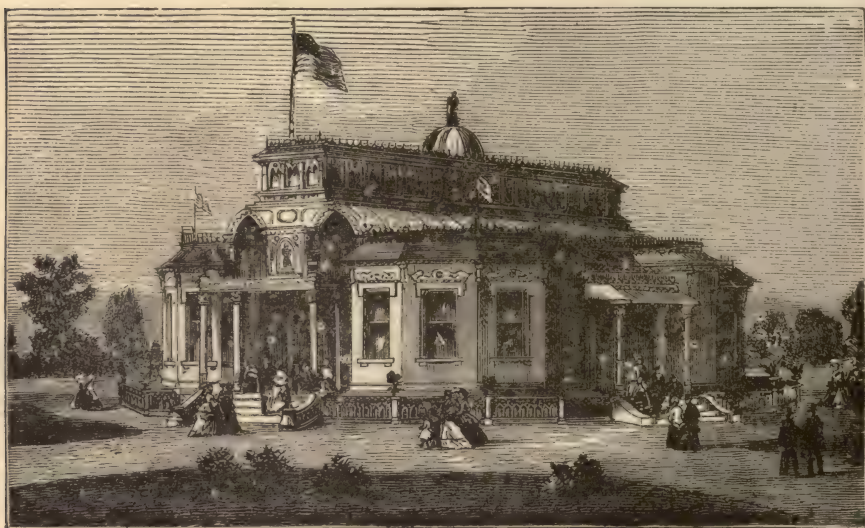
which was among the exhibits, and we are glad to be able to give a picture of it, which is represented on page 534.

In the United States, local exhibitions had been a common event for many years. The Franklin Institute, of Philadelphia—founded in 1824—early initiated a system of exhibitions for the purpose of promoting the Mechanic Arts, awarding medals and premiums to inventors, manufacturers and mechanics. Its first exhibition was held at Carpenters' Hall, in the autumn of 1824, attracting large crowds of people, and was attended with most fortunate results.

These exhibitions were continued, at intervals, for many years, increasing in public favor and usefulness. The last was held on

the fiftieth anniversary of the Institute in 1874, in a building covering an area of two acres available space on the ground-floor, with a large cellar for storage, and a four-story corner building for offices. It was the largest exhibition ever held in Philadelphia, the profits added greatly to the revenues of the Institute, and in every respect it was a complete success.

The American Institute, of New York, has for many years held similar exhibitions with the most satisfactory results; and, of late years, both Cincinnati and Chicago have held annual Expositions



INDIANA STATE BUILDING.

of Industrial Art in large, permanent buildings erected for the purpose, resulting in great success, both financially and in regard to the advantages derived from them by the exhibitors.

If the veteran navigator, Henry Hudson, could have looked forward two hundred and fifty years, when he ascended Delaware Bay, he would have beheld a spectacle almost as wonderful as the discovery of a hemisphere; certainly more wonderful than the record of his navigation along the coast of the New World.

The bright May morning which beheld the opening of the International Exhibition of 1876, would have shown to the bold

navigator tens of thousands wending their way westward like pilgrims to Mecca; all towards the Mecca of Civilization; the aggregation of the world's inventions, industries and arts, which was thrown open to the public on the 10th of May, 1876, without pomp, and without show. A certain degree of formality was attempted, but with the exception of a few speeches, the rendering of the Centennial Ode, and a few congratulations, there was none of that glitter which accompanies the openings of European displays of a similar character.



OHIO STATE BUILDING.

After the Exhibition was declared opened, President Grant with the Empress of Brazil on his arm, and the Emperor of Brazil with Mrs. Grant, walked through the Main Building to the Corliss Engine, which was started by President Grant, and then the party visited several of the other buildings and President Grant gave a reception in the Judges' Hall, the exterior of which we engrave on page 539.

For several months it seemed as if financial failure would be the result of the Exhibition; but the great heat of the summer withheld hundreds of thousands who would have liked to spend

portions of every day in the week in those attractive Halls. As the cooler weather came, the crowds came also, and those who had made the most they could of the Exhibition during the months of May, June and July, and the early part of August had cause to congratulate themselves, for from the end of August until the close of the Exhibition, every building, especially the Art Galleries, were uncomfortably full.

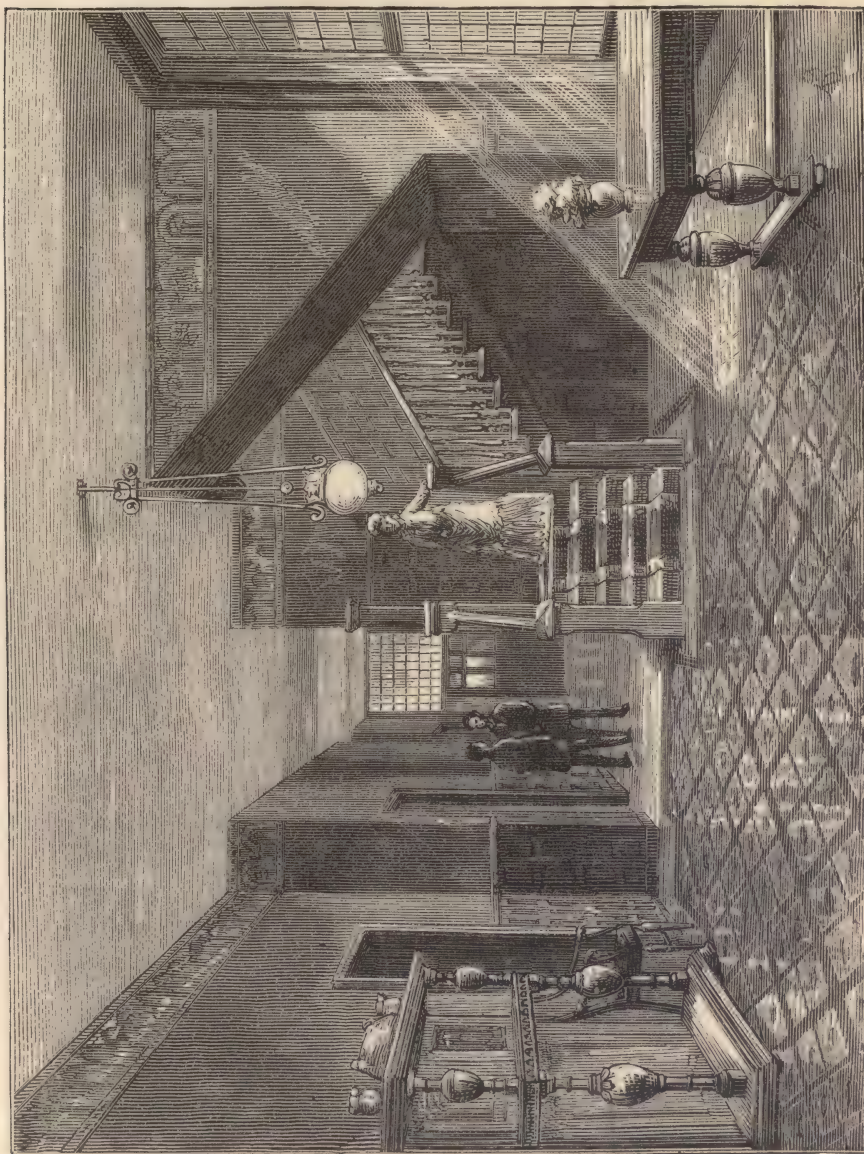
The Exhibition now was pronounced a financial success, but the doubt in the future was to what extent would that success



NEW JERSEY STATE BUILDING.

reach? Each day brought its hundred thousand visitors, and the system of State days which the Commissioners inaugurated, brought large accessions, until the day devoted to Pennsylvania beheld the largest number of visitors ever congregated in any International Exhibition on one day;—two hundred and fifty-seven thousand paid for admission at the turnstiles on the 28th of September, and when this information was cabled to London, the news simply electrified the English,—possibly the effect may have been the same on the French, for Paris had hitherto prided itself upon the fact that on Sunday the 27th of October, 1867, one hundred and

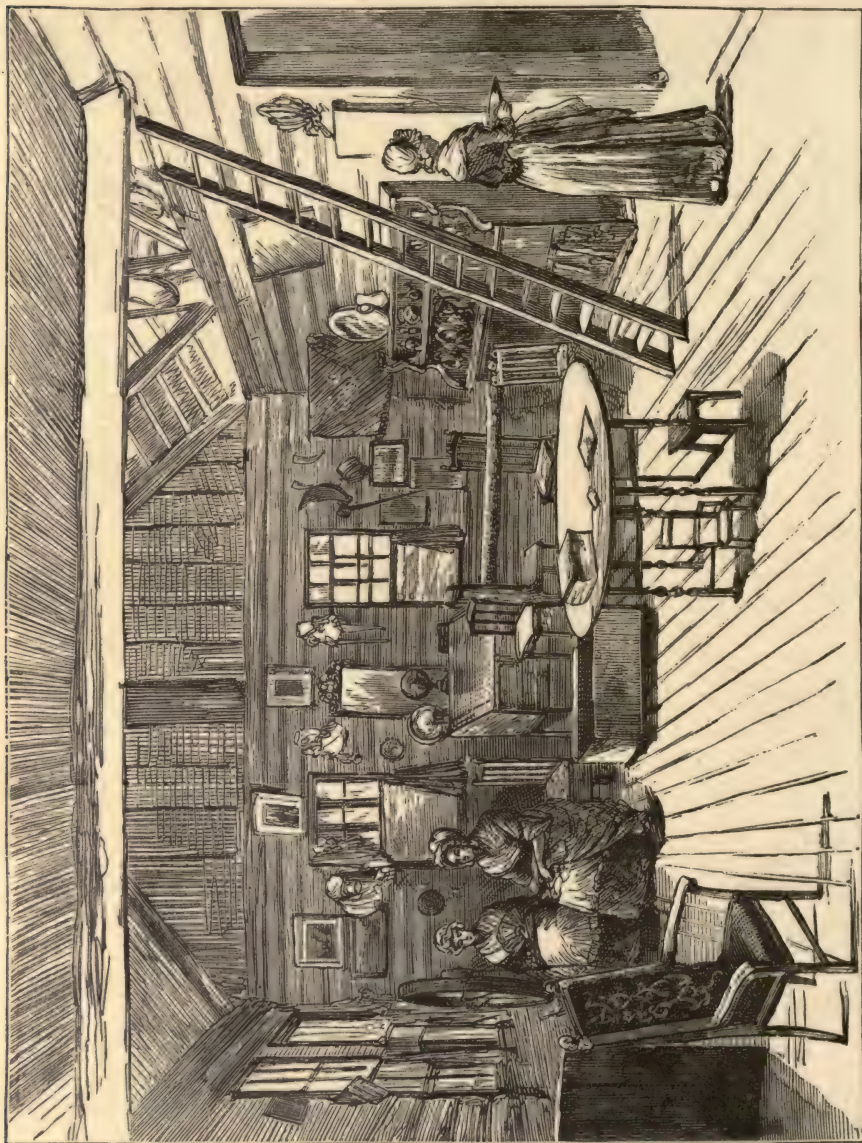
seventy-three thousand nine hundred and twenty-three visitors had paid one franc—twenty cents—each to see that Great Exhibition;



INTERIOR OF BRITISH BUILDING.

and now it rests with Paris, or any other European city to gather together in one enclosure, on one day, more than were gathered

on Pennsylvania day. It might be better to let some other person say it, but no more appropriate place than this can be found to



INTERIOR OF NEW ENGLAND KITCHEN.

say that all honor is due to the citizens of Pennsylvania for the patriotic support given to the Exhibition from the moment of its

inception until the day it made its grand effort. The causes of its success may be attributed to the following:—

1. The honesty and energy of the Finance Committee.
2. The display made by the exhibitors.
3. The appreciation of the public.

These were the principal elements of the success; but great praise and gratitude are due to the Woman's Committee for the aid it gave to the Commissioners before the opening, and for the admirable exhibit made in the Woman's Pavilion.

In the last few pages of our work we engrave several views of the interiors and pavilions which picturesquely dotted the grounds. Many of these, we believe, will remain permanently on the grounds, either under the care of the Fairmount Park Commissioners or of the Permanent Exhibition Managers.

We have already in this division referred to the numbers of visitors at previous exhibitions; it will now be interesting to compare those with the visitors to our own exhibition.

	TOTAL NUMBER.	TOTAL AMOUNT.
The Exhibition of 1851 was open 141 days. The greatest number of visitors was on Tuesday, October 7th—109,915	6,039,195	\$2,121,610
The Exhibition of 1855 was open 200 days, Sundays included. The greatest number of visitors was on Sunday, September 9th —123,017	5,162,330	\$640,506
The Exhibition of 1862 was open 171 days. The greatest number of visitors was on Thursday, October 30th—67,891.	6,211,103	\$2,042,651
The Exhibition of 1867 was open 217 days, Sundays included. The greatest number of visitors was on October 27th—173,923	8,805,969	\$2,103,676
These are exclusive of Billancourt.		
The Exhibition of 1873 was open 186 days, Sundays included. The greatest number of visitors was on Sunday, November 2d —135,647.	6,740,500	\$1,032,388
The Exhibition of 1876 was open 160 days. The greatest number of visitors was on Thursday, September 28th—257,168	8,181,080	\$3,900,438

The gross amount received by the Finance Committee from concessions, percentages on sales and royalties is \$495,010.75, making a total of \$4,395,448.75 from admissions and concessions.

It may thus be said that "men in nations" have visited the exhibitions of *the* nations; the total in round numbers of forty-two



MEDALS.

millions—equal to the population of our country. The increasing influence of exhibitions is best shown by the comparison of the greatest attendances at each exhibition, and we may bid adieu to our readers by affirming that the GREAT EXHIBITION OF 1876 is the greatest of all its predecessors, and that its lessons will not be lost and its influence will be felt by the American people during the second century of their country's existence.

